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The Noise About Noise

FROM the very numerous and verbose letters on abatement of noise in the air which have appeared in the London and provincial Press over a period of years, it has never been entirely clear whether the authors wish to advocate silent aircraft or the removal of airports from the vicinity of their own homes to a place where they would disturb someone else instead. The second alternative is as selfish as the first is unpractical. The suggestion that aircraft should be stopped from flying along the many approach lanes to London's airports, and the airports themselves located out in the country, is somewhat reminiscent of the king who got his feet wet while trying to keep the beach dry.

The most recent spate of correspondence in *The Times* and elsewhere is but another eruption from an old volcano. At an airfield thirty miles from London, one wall of a hangar is well on the way to being papered with plaintive letters clipped from the local Press. In this particular case a number of people, many of whom became residents long after the airfield was established, find that the Tiger Moths fill the air with loud noises and ruin their quiet week-ends. The fact that the young pilots forgo a quiet week-end in order to be prepared in emergency to defend that same air is conveniently ignored.

A straightforward request for a reduction in noise of commercial aircraft, not only at London Airport but also at every other city boasting a busy airfield, is reasonable and merits full attention. The noise of an airliner to those outside it is a real problem and should receive as much consideration as the silencing of the cabin for those within. The most disturbing sources of noise are the airscrews. During the war the Harvard trainer was the worst offender, and most people sympathized with the residents of Grantham, for example, when they suggested after several years that they had had their share of this particularly shattering racket. Fortunately, by keeping down the r.p.m. and especially the tip-speed of an airscrew, the noise can be held within bounds.

Power units themselves are more difficult to silence. Almost any form of silencer in the exhaust system produces back pressure, and this in turn leads to a reduction in power. For take-off a heavily-loaded commercial aircraft needs every scrap of power it can get. Silencing devices which do not adversely effect the power output are altogether too large for an aircraft to carry. Had this problem been tackled gradually over a long period, at least a partial solution might have been found, but, as Sir Geoffrey de Havilland has pointed out, we fly with engines developed in the first place for war, in which performance counts above all else.

The continuous noise of the exhaust or efflux from a gas turbine is a great deal less penetrating and disturbing than the pulsating sound produced by a piston engine, but again a practical means for silencing it is hard to find. It may be recalled, however, that in the experimental Metrovick F/3, a turbojet with ducted-fan thrust augmentation, an annular jet of cold air from the fans surrounded the hot jet from the turbine, and that this was found to have a marked silencing effect. In addition, there are means whereby particularly troublesome frequencies in the noise of a jet can be altered or eliminated. The high-pitched whine of the compressor—more audible in some units than in others—is almost impossible to shut in.

There are certain facts, however, which point to a reduction in the noise nuisance in years to come: turbojets are quieter than piston engines of comparable power; axial-flow compressors are quieter than the centrifugal type; jet-powered aircraft climb faster, both in rate and forward speed, and so are out of earshot more quickly; they also operate normally at very high altitudes and are thus almost inaudible in transit; and jet-powered airliners will not be stacked over airfields.

It is unfortunate, but seemingly unavoidable, that houses should be built right up to the boundaries of airfields, for until aircraft are able to descend and ascend vertically they must pass low over some roofs. As one newspaper reader says, "It is an established fact that to disembark passengers, a modern aircraft must approach the ground sufficiently closely to enable those passengers to step down without injury."

A businesslike array of Meteor 7 jet trainers lines the tarmac at Driffield, East Yorkshire, the base of No. 203 Advanced Flying School.

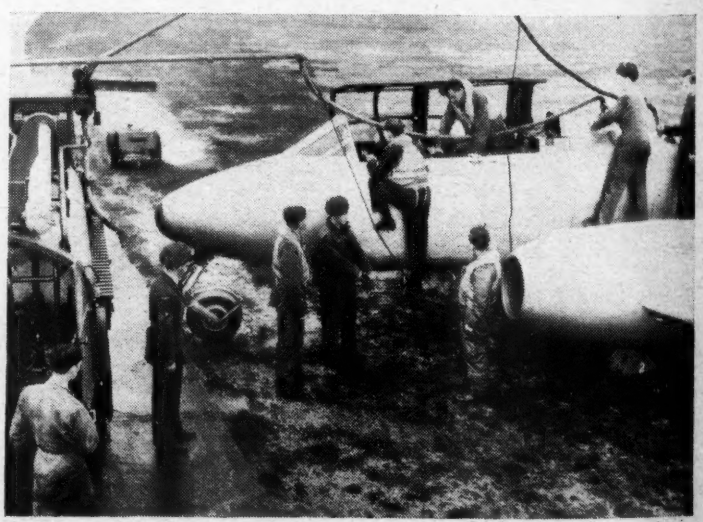
New Jet Conversion School at Driffield

DIRECT conversion from Harvards to Meteor 7s by pilots under training in the R.A.F. was described recently as "revolutionary." The adjective might have been apt two or three years ago, but a more appropriate word now would seem to be "logical." With the exception of a few squadrons of Hornets which are employed for long-range duties—intruding, escort, and so forth—no piston-engined aircraft remain operational in the regular squadrons of Fighter Command, and an intermediate piston-engine stage in training is therefore redundant and uneconomical. The very few pilots destined to fly Hornets at Home, or Tempests or Spitfires overseas, will have to convert—or revert—to these types.

A newly formed unit, No. 203 Advanced Flying School, Driffield, is now busily engaged in converting Harvard pilots to jet fighters. It is solely concerned with teaching them how to handle these aircraft to the limits of their performance, and no operational training in the sense of tactics and use of weapons is given.

Fortunately, jet fighters are in the main rather easier to handle than the piston-engined types they replace; had this been otherwise the direct step from the Harvard might not have been so simple. The Meteor and Vampire are especially pleasant to handle and, of course, the Mk 7 Meteor is a two-seater intended for dual instruction. This machine has become an important link in the training scheme for fighter pilots, and it is probably unique among trainers in having a higher performance than the short-nosed, single-seat fighter from which it was developed. A very fine production job has been done by the Gloster Company in turning out a very large number of these trainers during recent months.

No. 203 Advanced Flying School, in Training Command, shows signs of being a favourite child. It has a most important job to do; it has the task of justifying a new



"Flight" photograph.

Short flights and a very quick turn-round characterize the flying training schedule. Pupils and instructors change over while the ground crew replenish the aircraft tanks.

An instructor occupying the rear seat gives last-minute directions to the u/t pilot in front.
"Flight" photograph.

policy; and, above all, it has to work fast to pass pilots through in the requisite numbers. *Flight*, having paid the School a visit and been privileged to fly in its aircraft, is now free to remark that some of the instructors are fearful that so much attention from visitors of all sorts will hold up their training timetable.

The School was formed—W/C. P. Burnett, D.S.O., D.F.C., was entrusted with the job—on August 15th last, and the first course arrived one month later, on September 14th. The majority of u/t pilots to whom we talked had come through the standard training stages — 100 hours' basic training on Prentices and 100 hours' applied flying on Harvards. There were others, however, trained during the war, who had returned to the Service after discharge and had been posted to Driffield on completing a refresher course.

No hard-and-fast curriculum has been worked out at this early stage, and, in fact, the two separate courses are each trying out a slightly different programme. Experience with the early courses will quickly indicate which is best. As stated earlier, the School is concerned only with accustoming pilots to handling turbojet-powered fighters. Recognizing that the trainees have only recently completed a long and strenuous course of ground training, the ground lectures at 203 A.F.S. are made as interesting as possible, kept to the minimum, and are devoted to essential practical instruction in preparation for flying in the Meteors and Vampires. The unit is equipped with Meteor 7s and 4s and Vampire 1s. The first course is now tackling its remaining ground lectures and flying in alternate doses, while No. 2 course tries out a three-week pre-flying lecture period and then almost whole-time flying for the last few weeks as weather permits.

Pilots on the courses are allowed to choose whether they will go on to Meteors or Vampires within proportional limits (approx. 13 to 9 ratio respectively), and we tried to discover what sort of considerations led to their choice. It seems that a few outspoken but not necessarily qualified members of a course may be responsible for leading all its members to choose one type. Some sort of guidance may therefore be necessary. On the other hand, there are individuals who think they would prefer beat-ups and low flying rather than high-altitude interception—their choice is

This photograph gives a fine impression of what the occupants of a Meteor 7 see when flying in formation.

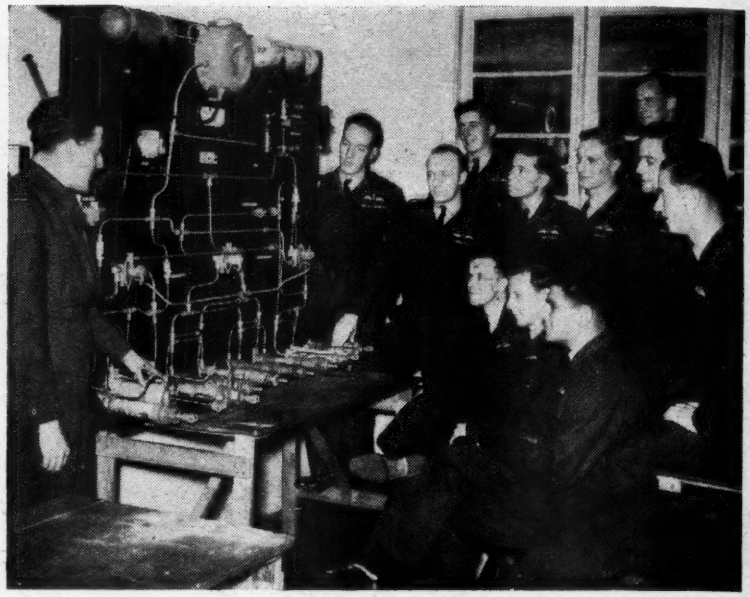
"Flight" photograph.

FLYING to the LIMITS . . .

the Vampire. Others believe twin experience will be more valuable in the long run, and so plump for Meteors. One or two also expressed a preference for the Meteor for bad weather and instrument flying.

Some four hours of dual in a Meteor 7 is the pupil's introduction to jet flying. This is followed by a first solo in the Meteor and afterwards solo practice in either a Meteor 4 or Vampire 1, according to selection. The total of flying is around 24 hours for Vampire pilots (of which 12 hours is dual in Meteors) and about 28 hours for Meteor pilots, including the same amount of dual but a little more solo. The effect of the new scheme will be to reduce slightly the time taken to train a pilot up to operational standard and, moreover, when he is posted to his squadron he will already have some experience of the aircraft with which it is equipped. In the past the squadron had often to devote some time to the conversion of its new pilots.

After passing through the new A.F.S. pilots will be posted for a few weeks to an Operational Conversion Unit, after which they will pass into the squadrons fully trained, but, of course, lacking in experience. We are told, incidentally, that the pilots on the staff of No. 203 A.F.S. have been selected primarily for their ability as flying instructors.



Several hours are devoted to ground lectures on the subject of cockpit layout, controls and services in the Meteor and Vampire.

The sort of things about which a pilot under training must be warned before he flies a jet fighter form an interesting study beyond the scope of this description. As a qualified pilot of less advanced aircraft he knows most of the answers, but there is a considerable difference in degree. Two details may be mentioned in this connection, the first of which is the need to anticipate engine requirements on a jet aircraft. Whether overshooting from a landing approach or when taxying, the response to power-lever movements is slower on the part of a turbojet, particularly at low r.p.m. Secondly, instrument flying at high speed presents many problems. This will be apparent to any pilot when it is realized that the normal climb of a Meteor 7 tries to put the horizon bar out of sight over the top of the standard instrument, that a Rate 1 turn (360 deg in two minutes) requires between three and four times the angle of bank of a trainer and, finally, that a not abnormal rate of descent on instruments is 15,000 ft/min. Quite obviously, until instrument development catches up with fighter performance, precautions have to be taken to nurse and interpret correctly the existing dials. Toppled gyros, a compass showing all the old errors, a rate-of-climb needle left hopelessly behind and permanently outside the scale, and primaries also on their stops, would not be much comfort when 20,000ft of cloud and ten minutes' kerosene lie between aircraft and runway.

Rapid descents from high altitude are not made easier, either in clear air or cloud, by the frosting-up of the screen and cockpit enclosure; this is the rule rather than the exception, and no effective means seems to have been found to prevent it. Pilots at present carry a cloth soaked in glycol with which to rub the transparent panels. This temporarily solves the problem but cannot be regarded as a good answer.

An additional hour and a half of I.F. experience has already been added to the syllabus. No mention was made of Link training though this is still useful for practising procedures.

The duration of instructional flights is limited to 40 minutes and solo practice to 30 minutes. As an added precaution the minimum quantity of fuel remaining in the tanks on rejoining the circuit must not be allowed to have fallen below 80 gallons. One overshoot uses up approximately 30 gallons of kerosene.

With such short flights it is essential to reduce turn-round time to a minimum if utilization is to be kept high. A battery of tankers stands by in readiness to meet each Meteor as it comes in, and as the chock is dropped in front of the nosewheel the pipes are passed over the cockpit to the filler caps. The replacement crew assist the returning pupil and instructor out of the cockpit, and in this way the stationary time of the aircraft between flights is kept down to between 6 and 8 minutes, and 6 to 7 hours flying per day can be achieved with each Meteor 7.

At the A.F.S. the pilots absorb that sense of urgency which is so desirable in an operational fighter squadron and important when flying very fast, short-duration aircraft. Incidentally, they always wear Mae Wests, K dinghies and an emergency oxygen bottle in order to grow accustomed to this standard paraphernalia.

Ground Lectures

Rather than discuss subjects covered in the ground syllabus we may indicate the scope of the training by quoting the following selected headings from lectures, which occupy about 60 hours:—

(1) *Airframes.*—Structure, fuel, oil and hydraulic systems.
(2) *Engines.*—Film and discussions on operation of turbojet units.
(3) *Theory of flight.*—High-speed flight, compressibility and Mach Number symptoms and recovery.
(4) *Engine and airframe handling.*—Drills, vital actions, emergency procedures.
(5) *Cockpit.*—Blindfold drill on Meteors and Vampires.
(6) *Instrument flight.*—Limitations, altitude interpretation, approach aids, physiological aspects.
(7) *Parachute descent.*—Care of 'chute, dinghy and Mae West, Martin-Baker ejector seat (film).
(8) *Navigation.*—Pilot navigation, mental D.R., high and low-level planning and maps and charts, Magnosyn and E.2 compasses.
(9) *Air Traffic Control.*—Local, zones, areas, clearance, altimeter settings, search and rescue organization.
(10) *Meteorology.*—All-weather flying, charts, flight planning, pressure-pattern system.
(11) *Aviation medicine.*—Anoxia, decompression sickness, ears, sinuses, positive and negative g, bends, oxygen in parachute descents.
(12) *Signals.*—Facilities, procedures, discipline.

Noteworthy in the above list is the inclusion of high-altitude navigation and upper air met., and also aviation medicine. A flying doctor has been posted to the unit and his arrival coincided with the first seasonal ailments. Pilots with heavy colds are not normally required to fly at very high altitudes. Meteor 7s are taken to 35,000ft without pressure, and trainees take the Mk. 4s to 40,000ft. Due to the frequent closing and opening of canopies, unserviceability of pressure cockpits seems likely to present a problem.

On the flying side, exercises include control at high speed up to Mach 0.82. The aircraft are not at present equipped for night flying, but in the new year they will probably be modified for such operation. At this early stage the station is also short of approach aids. It is hoped that G.C.A. will be installed.

The impression was gained that an energetic and successful start has been made with a timely innovation in pilot training at this newly formed school.

SKEETER II PERFORMANCE

First Flight of Two-seat Gipsy-powered Helicopter

NEWS of the Cierva Skeeter II's successful first flight, at Eastleigh on October 20th, follows the very favourable impression made by this smallest of British helicopters when "statically" displayed at the recent Farnborough Show. Alan Marsh, chief pilot of the Cierva Autogiro Company, Ltd., made two flights, totalling 30 min, which were described as "very satisfactory."

By comparison with the Skeeter I, which made its first flight just over a year ago, the newer production model has a more shapely, rounded front fuselage, housing the two-seat cabin and the 145 h.p. D.H. Gipsy Major 10; there is also a wider-track undercarriage and a redesigned tail-rotor boom, of circular section, and metal covered.

Partly uncowled, the Cierva Skeeter II climbs away on its first flight.

Dual control is incorporated, and demonstrations during the past year by the Mk. I have given evidence of exceptionally good handling characteristics.

Accompanying figures indicate that considerable gains in performance have been achieved by the installation of the more powerful Gipsy Major 10.

CIERVA SKEETER W.14 Mk. 2

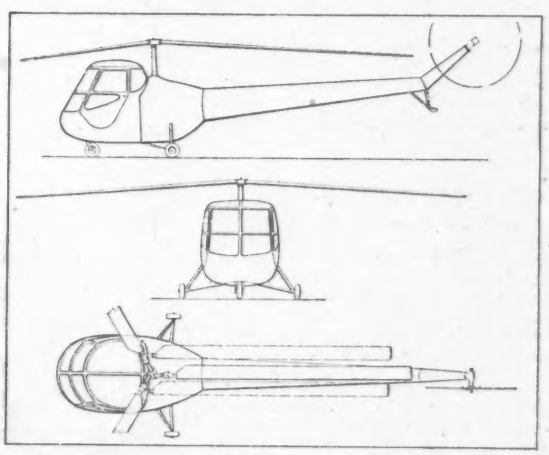
One D.H. Gipsy Major X (transverse mounting)

Weights and Dimensions

Empty weight	1,200 lb
Max disposable load	600 lb
Max all-up weight	1,800 lb
Max engine power (ICAN s.l.)	145 h.p.
Max engine speed	2,550 r.p.m.
Max cont engine speed	2,300 r.p.m.
Max rotor speed	330 r.p.m.
Max cont power (ICAN s.l.)	128 h.p.
Main rotor diameter	32ft
Tail rotor diameter	5.67ft
Overall length	38ft 4½in
Overall length (folded)	28ft 5in
Overall width	32ft
Overall width (folded)	7ft 4½in
Overall height	10ft

Sea-level Performance (ICAN Conditions)

Max speed	95 m.p.h.
Speed at max cont power	88 m.p.h.
Speed at max w.m.	77 m.p.h.
Max range speed	73 m.p.h.
Max endurance speed	40-45 m.p.h.
Max cont power consumpt.	10 gall/hr
Max w.m. power consumpt.	7.5 gall/hr
Max range consumpt.	7.1 gall/hr
Max endurance consumpt.	5.2 gall/hr
Max range (18-gal tank)	186 miles
Max endurance (18-gal tank)	3.5 hours
Max vertical rate of climb	600ft/min
Max inclined rate of climb	1,030ft/min
Vertical climb ceiling (hovering inside ground cushion, max rating)	7,200ft
Flight ceiling (400ft/min best rate of inclined climb, cont rating)	8,250ft
Absolute ceiling (for level flight, max rating)	14,250ft



BEAMONT'S SONIC FLIGHT

TO our uninhibited American contemporary *Aviation Week* we are indebted for an intimation of what has long been known by a number of people in this country; an official ban has prevented—and still prevents—W/C. Beamont from being accorded full credit for the achievement concerned. "Although John Derry, the de Havilland test pilot," runs the American report, "is officially credited as being the first British pilot to hit sonic speed when he dived the D.H.108, sweptwing research plane for the Comet project, just past Mach 1 a year ago, informed British sources believe the honour really belongs to English Electric Co. test pilot R. P. Beamont, who hit Mach 1 several months before Derry while flying a North American F-86A in California. Beamont is the pilot who made S.B.A.C. show visitors take a second look at the Canberra twin jet light bomber with his incredible display of low level speed and manœuvrability with the big plane now in production for the Royal Air Force."

That the North American F-86A Sabre has more than once been dived to supersonic speed is now common knowledge: less publicized has been a more recent report of its attainment of "Mach 1 plus" in level flight at high altitude. The type, which holds the world's speed record, is being delivered to the U.S.A.F. in quantity.

NEW LAMINATED PLASTIC

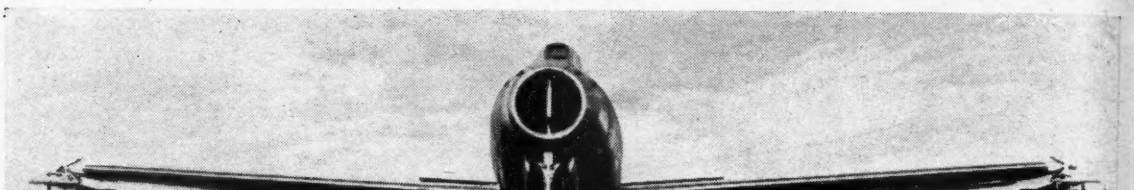
A NEW laminated material of glass fabric bonded with silicone resin has been developed by Bakelite, Ltd. Claimed to possess greater heat-resistance properties than does any other known plastic, it should have certain useful applications in the field of aircraft electrical equipment.

THE NEW JANE'S

FAMILIAR blue covers notwithstanding, this year's *Jane's** —the fortieth issue—is a *Jane's* with a difference. A three-column make-up has been adopted for the main body of the work (though not for that portion dealing with power plants) to allow greater latitude in the choice and location of illustrations. Of 542 half-tone photographs and general-arrangement line drawings, 457 are new.

Mr. Leonard Bridgman has had the happy notion of placing several pages at the disposal of Sir Frederick Handley Page and Mr. Glenn L. Martin, who reflect most engagingly upon the development of flying in the past forty years. Air Commodore F. R. Banks contributes an admirably concise survey of power-plant progress during the same period.

* *Jane's All the World's Aircraft, 1949/50," compiled and edited by Leonard Bridgman. Sampson Low, Marston and Co., Ltd., three guineas net.*



BROCK'S BENEFIT: A check will confirm that thirty-six 5-inch rocket projectiles supplement the six "50-calibre" guns of this Republic F-84 Thunderjet, in short-range ground-attack trim. The desirability of internal stowage and automatic launchers will be evident; but meantime the Ministry of Supply might do well to follow this American example of ingenious adaptation. As recorded below, the first Thunderjets to arrive in this country landed at Prestwick on Sunday.

HERE and THERE

Uplift

RESERVE Command has offered facilities for glider training to A.T.C. members of an approved school at Ardale, Essex. The Children's Committee of the L.C.C. has commented: "We consider that this activity has a positive training value for the type of boy who becomes a delinquent through a desire for adventure, and we have decided to allow boys to be taught gliding, subject to parental consent being given in writing in each individual case."

Superforts for the R.A.F.?

WITH a report from Washington that the way has been cleared for Britain to receive—on loan or as a gift—up to 100 B-29 bombers, the well-worn "Superfortresses for the R.A.F." story has lately been revived. No comment is forthcoming from the Air Ministry. Though technically superior in certain respects to the Avro Lincolns now in R.A.F. service, the B-29 is much inferior to the B-50 Stratobomber now being issued to U.S.A.F. units and employed on a limited scale during *Exercise Bulldog*.

The problems of adopting an American-type bomber are more exacting than is commonly appreciated. Spares have to be laid down (though these, in any case, exist in this country for the use of the U.S.A.F.) and servicing and operating experience must be accumulated.

Austers in the Antarctic

THE R.A.F. Antarctic unit, commanded by S/L. B. Walford, which will accompany the joint Norwegian-British expedition to Queen Maud Land, has taken delivery of its two Auster 6s. The aircraft are painted orange to facilitate recognition against a white background, and are equipped with wheels and skis.

Operating from the pack-ice, they will seek a passage through it for the expedition's ship, the 700-ton Norwegian sealer *Norsel*, and will reconnoitre for a suitable camping site. The *Norsel* leaves Oslo on November 15th, and will call at London on November 17th. S/L. Walford's command will be the first R.A.F. unit to operate in the Antarctic, and its five members were selected from 250 volunteers.

Empire Air Memorial

COOPER'S HILL, in Surrey, which overlooks the Thames at Runnymede, will be the site of a memorial to some 20,000 members of the Air Forces of the British Commonwealth who were killed in action in Britain and N.W. Europe during the war and have no known grave.

ROYAL POSTING: Recently, when joining his ship, the destroyer *Chequers*, the Duke of Edinburgh flew to Malta in a Viking of the King's Flight—the first occasion on which one of the Royal Family has travelled by the Flight on taking up Service duty.

Historic Turbojets

A SPECIAL article in this issue recalls the flight-testing of early British turbojets in the Gloster E.28/39. The first of these historic units to fly, the W1, has this week been presented to the nation by Power Jets (Research and Development), Ltd., while the W1X, the pre-flight version, is being given to the United States as a symbol of Anglo-American technical collaboration during the war.

The ceremonial reception of the W1 and the speeding of the W1X on its journey to America were due to be performed yesterday at the Science Museum, South Kensington, by the Minister of Supply, Mr. Strauss. The formal handing-over of the W1X will take place at the Smithsonian Institute, Washington, on November 8th.

Transatlantic Thunderjets

THE fourth crossing of the Atlantic by jet aircraft was completed last Sunday, when two Republic F-84 Thunderjets landed at Prestwick. R.A.F. Vampires made the first crossing—from east to west—and there have since been two flights by U.S.A.F. Shooting Stars. The leader of both the previous American crossings, Lt.-Col. Dave Schilling, flew one of the F-84s.

Their visit is officially stated to be for the purpose of "co-ordinating operational and training techniques with the R.A.F." The Thunderjets will be based at Tarrant Rushton, Dorset, the airfield from which Flight Refuelling, Ltd., are operating the Gloster Meteor, equipped for air refuelling, which recently remained airborne for 12 hours. The U.S.A.F. is said to have shown considerable interest in the new technique employed by this experimental Meteor.

Second Delivery

MR. CHRISTOPHER DYKES, B.O.A.C.'s assistant chief of technical development, lectured in Hull last week to the Brough Branch of the R.Ae.S. on operating factors likely to affect the design of future civil aircraft. His lecture was condensed from one delivered at the Anglo-American Aero-

HERE AND THERE . . .

nautical Conference earlier this year (see *Flight*, June 23rd), and is likely to be published shortly in book form.

Record Attempt

FLYING a 185 h.p., four-seat Johnson Bullet, Mr. J. Brazil will, it is reported, shortly make an attempt to beat the late Bill Odom's long-range record for light aircraft. The first leg of his flight will be from Oklahoma to Rome—a distance of 5,500 miles—and an attempt will later be made to raise this figure by flying the 6,300 miles non-stop to Oklahoma from Tokyo.

A.P.R.A. Reunion

A REUNION dinner of the Air Public Relations Association will be held on Friday, November 4th, at the Martiney Restaurant, Swallow Street, London, W.1. Speakers at the dinner will be the Association's patron, Mr. Arthur Henderson, Marshal of the R.A.F. Lord Tedder. Sir Roy Dobson and Sir Guy Nott-Bower. Air Chief Marshal Sir Philip Joubert, chairman of the Association, will preside, and the guests will include Sir James Barnes, Permanent Under-Secretary of State for Air, Air Marshal Sir Richard Peck, A. Cdre. Lord Willoughby de Broke, Sir Arthur Street and A. Cdre. Harold Peake.

Apollo Pressure-testing

AS part of the pressurization-testing programme for the Armstrong Whitworth Apollo turboprop airliner, the front fuselage was recently "blown" with water to a pressure of 13 lb/sq in during a test of its ability to maintain an equivalent 8,000ft cabin-altitude at 25,000ft. The pressure differential actually required for such conditions is 5½ lb/sq in.

The test took place underground in a wartime emergency hospital, which was flooded with 27,000 gallons of water, and the behaviour of the Apollo fuselage section was measured with waterproof electrical instruments.

AID TO SHIPPING: An outsize in radomes is carried by this Douglas Skyraider strike aircraft of the U.S. Navy. It contains new equipment designed to increase the effectiveness of ship-borne radar by circumventing the effect of earth curvature on the reflection of beams to and from points beyond the ship's horizon.

On The Air

DAVID MARTIN, of the B.B.C., learned to fly during the summer in a Miles Messenger of the Wolverhampton Flying Club, with F/L. S. Robinson as his instructor. Peter Cairns, flying as a passenger, recorded commentaries on the course, and they will be broadcast in a series on the Midland Home Service under the title "Student Pilot"; the first is at 6.30 p.m. on Monday, Nov. 7th.

FORTY YEARS BACK

"Three Bleriot monoplanes were brought out to be photographed, and on lining up were joined by the Windham monoplane. . . . Then, at the moment when shutters clicked, Mr. Windam was gently precipitated to the ground, the main frame of his machine snapping about midway of its length."
—*From "Flight" of October 23rd*, 1909.

London — N.Z.

THE Canterbury International Air Race Council has invited inquiries from all parts of the world concerning participation in the 1953 London - New Zealand Air Race. Mr. H. D. Christie, president of the Council, recently arrived in London to discuss details of the race with the Royal Aero Club.

JET NOVELTY: One of the most attractive of French light aircraft is the Fouga Cyclone, shown in flight for the first time. The Turbomeca jet unit (200 lb thrust) is intended to give the Cyclone a maximum speed of 160 m.p.h.

NEWS IN BRIEF

EVOLVED by the R.A.E., a method of moulding plastic components without the use of either positive or negative (vacuum) pressure is described in the current number of *British Plastics* and in the forthcoming issue of *Aircraft Production*. Durestos is the material employed.

* * *

It is reported that the Swedish Aero club is to stage a world championship soaring contest at Orebra, Sweden, in July, 1950. Competitions will be divided into three events: free distance combined with height, goal flights and goal speed.

* * *

Published for the British Electrical and Allied Manufacturers' Association by Iliffe and Sons, Ltd., the first (1949-50) edition of the *BEAMA Catalogue* provides for the overseas market full data on the products of the entire electrical industry.

* * *

Mr. J. A. Hunt, general manager of the Hymatic Engineering Co., Ltd., accompanied by Mr. A. H. A. Bastable, the company's aircraft specialist, left on October 16th for a brief tour of Sweden, Denmark and Holland. They are visiting aircraft constructors and operators with a view to establishing a technical service for Hymatic equipment.

* * *

Equipment supplied by the Self-Priming Pump and Engineering Co., Ltd., for the Bristol Brabazon I (described in *Flight* of September 29th) includes four B.P. Mk. 3 electrically driven fuel booster pumps, each capable of supplying 400 gal/hr at 10 lb/sq in; they are installed in pairs in a collector-box in each wing. The same firm's R.P.M. 4 Mk. 1 pumps are used to supply fuel to the Radiation burners for the de-icing systems.

* * *

Mr. William Courtenay has returned to this country after a 40,000-mile flight round the world. During the 90-day tour he gave some 70 lectures and showings of his own colour films to U.S.A.F. and R.A.A.F. units in Japan and other areas of the Far East. His film of the tour itself is being shown to various aeronautical organizations this winter, commencing with the Handley Page Engineering Society last Tuesday.

Inside the Comet

Accommodation, Cockpit Layout and Systems of de Havilland's Pure-jet Airliner

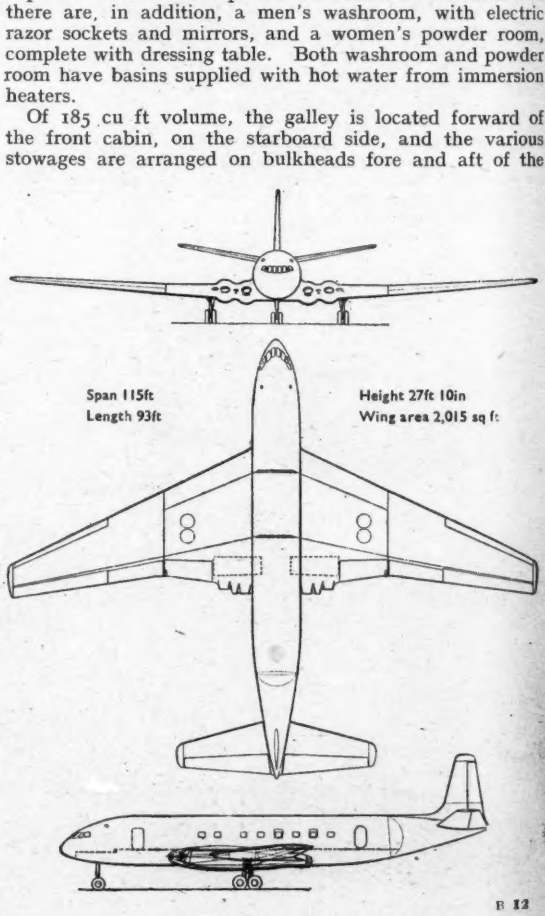
GRADUALLY it becomes possible to describe the de Havilland Comet high-speed, jet-propelled transport aircraft in progressively greater detail, and though performance and the more intimate features of construction remain confidential, many gaps in an unusually promising picture can now be filled. On 80 flights the Comet, which is designed to cruise at about 500 m.p.h. at 40,000ft, has completed 80 hr, and has shown itself to have interesting possibilities for shorter stages as well as for the world trunk routes. The makers state that with only a little more development the Ghost turbojet, four of which power the Comet, will be giving a longer overhaul period than piston engines, and call for much less, and much simpler, daily maintenance.

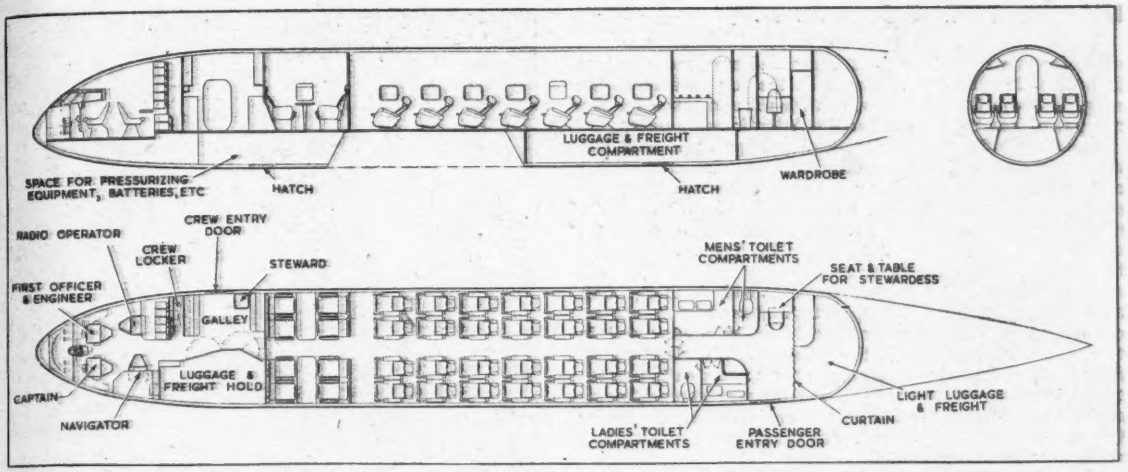
A typical arrangement of the fuselage interior (not yet finally accepted by B.O.A.C.) provides for 36 passengers in two cabins. Forward of the front-spar bulkhead is a compartment with eight fixed, facing chairs and fixed tables; aft of the bulkhead is the main cabin, to seat 28 passengers in fully adjustable chairs at 45in pitch and in seven rows of four (two abreast on each side of the central gangway). The forward compartment has two windows and in the main cabin one window is fitted adjacent to each pair of chairs. Two windows in the main, and two in the forward, cabin form emergency exits. The central gangway is 17in between arm-rests and the minimum head room is 6ft 5½in.

The adjustable chairs in the main cabin embody the B.O.A.C. type fully reclining movement; they are 24in wide, measured over the arm-rests, and have ashtrays, lifebelt stowage and sockets for a detachable table. Hat racks are provided in each cabin and there is a wardrobe at the vestibule by the main entry door. Stowage for up to 200 cu ft of light luggage is provided nearby. In addition to the main ceiling lights above the gangway there are individual reading lights (and stewards' call buttons) at each seat and gangway lights are provided at floor level. Smoking is permitted during flight throughout the passengers' and crew's quarters.

At the after end of the main cabin, on the port side, is the passengers' entrance door—4ft 8in high and 2ft 6in wide—providing ready access to the light-freight and luggage space at the extreme rear of the cabin. The forward entry door gives direct access to the forward freight-hold and galley, and serves also to admit the crew. Separate lavatories are provided for men and women and there are, in addition, a men's washroom, with electric razor sockets and mirrors, and a women's powder room, complete with dressing table. Both washroom and powder room have basins supplied with hot water from immersion heaters.

Of 185 cu ft volume, the galley is located forward of the front cabin, on the starboard side, and the various stowages are arranged on bulkheads fore and aft of the





Interior layout for 36 passengers. Another scheme allows for 24 seats instead of 28 in the main cabin; the forward compartment has eight seats in both versions. Greater seating capacity, and even a longer fuselage, have been considered.

crew entry door. The forward bulkhead is occupied by a large cupboard, cutlery drawers and a waste-bin under a table top; the table has a sink let into one end. Above are a glass-stowage cupboard, urn, and crockery-stowage rack. Provision is made on the after bulkhead for a Crittall-type oven under another table top, and above this are two additional cupboards for crockery and miscellaneous equipment. A tank holding twenty gallons of water is fitted in the roof above the forward freight-hold adjacent to the galley. Seats for occasional use are provided for two stewards.

Mail, Freight, Luggage

Three compartments—all accessible during flight—are provided for a total of 585 cu ft of mail, freight and luggage. The forward hold, above the floor on the port side, forward of the passenger cabin, holds 200 cu ft; the centre hold, under the floor aft of the centre section, provides 185 cu ft; and the rear hold takes 200 cu ft of light freight. Incorporated in the front hold is a separate compartment for bullion or diplomatic mail.

There is accommodation for a flight crew of four in one cabin, where full dual control is provided for the two pilots. To port is the captain's seat, with conventional flying and engine-control layout and nosewheel-steering facilities on the control column. The first officer's station is on the starboard side. Each station is equipped with full flight and radio instrumentation, and there is a central engine instrument panel visible to both. Outboard of the first officer is a control panel with pressurizing controls and instrumentation, fuel jettison and pump controls, fuel-system instrumentation, electrical system control switches and instrumentation, and controls and instrumentation for de-icing. The seats at both stations provide vertical adjustment and 360 deg swivelling, allowing the pilots to assume alternative positions for engineering or navigational duties. A direct-vision panel is let into the windscreen.

Behind the first officer is the radio operator's station. Space provision is made for M.F./H.F. communication equipment, V.H.F. R/T communication equipment, A.D.F. (duplicated), I.L.S. and omni-range equipment, high- and low-range altimeters, D.M.E., Loran and intercommunication. There are no external projecting aerials. The main fin is insulated from the stub fin and used for the H.F. aerial; V.H.F. and I.L.S. O.R.B. aerials are housed in dielectric tips on fin and tailplane, and the M.F. grid aerial is mounted in the nose-wheel doors behind a dielectric flush panel. A.D.F. loop aerials are installed in the top fuselage behind flush dielectric windows, the I.L.S. glide-path is behind the windscreen and the remaining I.L.S. marker, D.M.E. and radio altimeter aerials are mounted behind flush dielectric panels in the underside wing-root fillet.

The navigator is placed behind the captain and is provided with Loran, D.M.E. indicator, A.D.F. indicator, I.L.S. O.R.B. indicator, G.4.B compass master indicator, high-range radio altimeter, A.D.F. and D.M.E. controllers. Adjacent to his seat is a periscopic sextant housing.

An emergency oxygen system gives sufficient supply for descent at the maximum rate from the operational ceiling of 40,000ft to a height of 15,000ft; in addition, there are four portable oxygen sets. Provision is

"Flight" photograph.

At the end of each test flight the Comet is immediately refuelled and inspected. The chute on the left is for convenience in removing ballast.

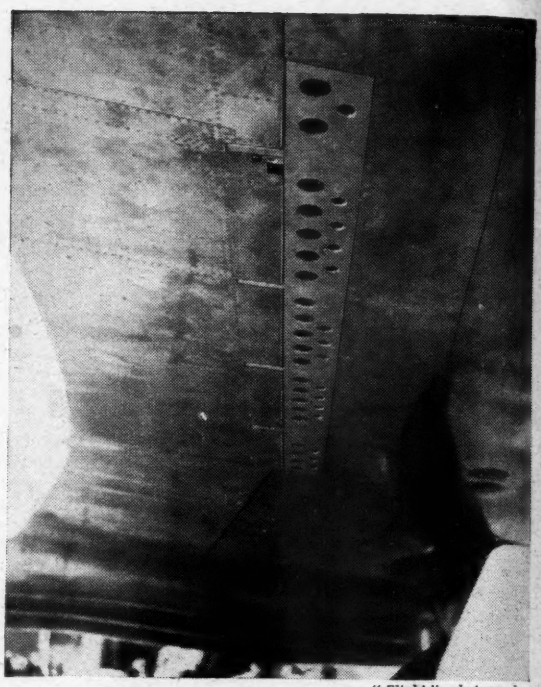
INSIDE THE COMET . . .

made for two 15-seat dinghies, radio and emergency rations in automatic blow-out stowages in the top surface of the wing, between the tail pipes, but weight allowance for this equipment has been made for the Atlantic route only.

The engine fire zones, wing-leading-edge equipment bay and de-icing bay have a methyl-bromide fire-extinguisher system. Warning of fire in the fuselage is given by smoke detectors in the equipment bay, control-booster bay and rear under-floor freight-hold. The extinguisher system comprises a semi-portable 12.5-lb CO_2 bottle which may be plugged into built-in sockets in the under-floor zones and, by means of a trigger control, will discharge CO_2 at will. A portable 2-lb CO_2 bottle is stowed in the central cabin and two 1½-lb water/glycol bottles are stowed in the main cabin and one in the galley. All fuselage under-floor zones are fitted with access hatches and small observation windows and the freight and luggage compartments above the floor are readily accessible in flight. A master fire-warning bell rings when any fuselage or engine-fire-zone warning has operated.

Thermal de-icing for the power-unit air intakes, wing leading edge, wing-tip slats, tailplane and fin leading edges will be fitted when the system has been sufficiently developed. Windscreen de-icing is by fluid spray, which serves also the windscreen wiper; additionally, there is a dry-air sandwich for insulation and an internal de-misting spray. For ice detection at night, a lamp illuminates the starboard leading edge and air intake.

The main electrical system is operated at 24 volts (nominal) D.C. Four engine-driven 8.5 kVA alternators provide power; the three-phase output of each rectified by a selenium-type blast-cooled rectifier, the output subsequently being paralleled. The total output per alternator/rectifier is 250 amp, less a varying amperage up to 30 amp for excitation of the alternator. Field regulation is by carbon-pile regulator and is maintained at 28 volts ± 0.25 V. Pre-flight power with turbojets running can be obtained up to 150 amp per alternator/rectifier; without the turbojets running power is obtained from ground equipment, the power-handling capacity of the input system to the main bus bar being 400 amp at 28 V. The auxiliary power source is alternating current at 115 V, 400 cyc, three-phase, and 26 V, 400 cyc, single-phase, provided by D.C. motor-driven invertor sets. The rectifiers are mounted in pairs in the wing leading edge between the air intakes and the voltage regulators are mounted adjacent to the rectifiers. Batteries are located immediately inside the access door, where they are convenient for servicing and removal. The main fuse and circuit-breaker panel is in the bulkhead behind the navigation station in the control cabin; thus, all fuses and circuit-breakers are readily accessible to the crew for replacement and re-setting.



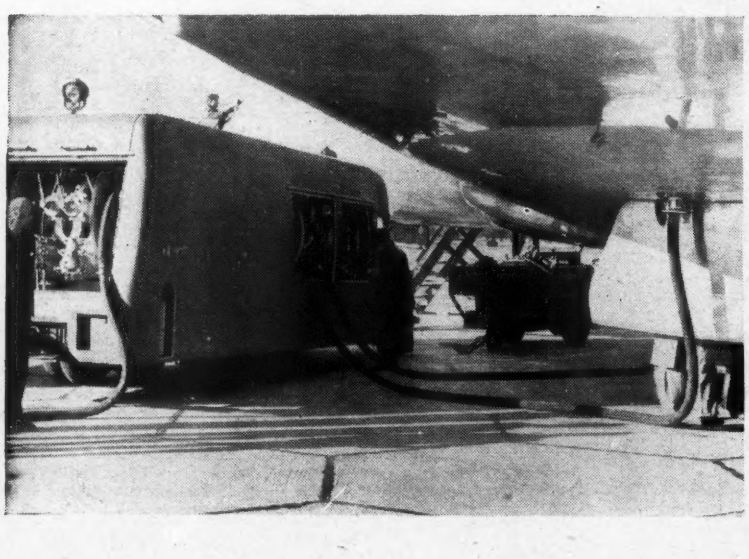
"Flight" photograph.

The air brakes on the underside of the port wing. There are four pairs, upper and lower, on each side, at front and rear side positions.

Flying controls are power-operated by completely duplicated hydraulic boosters, with a duplicated source of power delivered through two entirely separate systems. A Smith's S.E.P.1 automatic pilot is standard. Split flaps are fitted over the inboard sections of the wing and there are plain flaps outboard; the ailerons, moreover, are arranged to droop when the flaps are lowered. A lever on the pilot's pedestal gives preselective flap control. To promote deceleration for rapid descent without high forward speed, and to provide a means of altitude regulation during the stand-off phase, air brakes are fitted on upper and lower wing surfaces.

Unlike the prototype, production Comets will have four-wheeled bogie units on each main undercarriage leg, in conjunction with the twin nosewheels. There are two separate hydraulic power systems for retraction and lowering, supplemented by a hand pump for emergency lowering. A wheel on the control column allows the captain to steer the nosewheel. The wheel brakes are of the twin-disc type, with a completely duplicated hydraulic system.

There are four separate hydraulic power supply systems: (1) Main system, with two engine-driven pumps, for undercarriage, flaps, nosewheel steering, air brakes, wheel brakes and secondary flying controls; (2) booster system with two engine-driven pumps, supplying main flying-control boosters only; (3) standby system, with one pump driven by an electric motor, for reserve wheel brakes and emergency



"Flight" photograph.

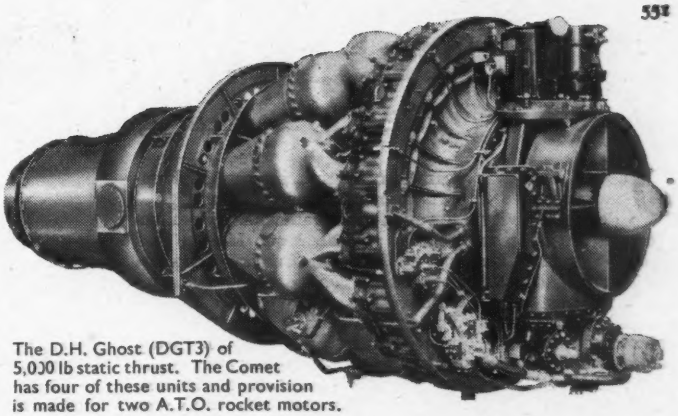
For refuelling, the modern underwing system is employed.

operation of undercarriage and flaps (twin hand pumps will also be fitted as part of this system, to provide a second emergency method of lowering the undercarriage); and (4) booster emergency system, with one electrically driven pump, for secondary flying-control boosters only.

Failure of any of the four turbojets will not affect main or booster systems, and change-over from primary to secondary boosters will be by manual control. A separate accumulator, charged by the standby system pump, supplies pressure to the wheel brakes for parking.

All fuel is carried in the wing, the tanks in the centre section being of bag type, and those outboard, integral. The fuel system is designed for pressure refuelling at a rate of 150 gal/min, but also for normal over-wing refuelling. Normal feed is by immersed booster-pump pressure, there being two pumps in each tank, and provision is made for suction feed from each tank in case of booster-pump failure. Each pump can be removed from the under surface of the wing without draining the tanks. Air for tank venting is drawn from a leading-edge intake. Fuel may be jettisoned from the centre-section tank and the two inboard tanks on each side by blowing it out by ram air pressure from the leading-edge intake. Access to the centre-section bag tanks and all integral tanks is by way of removable manholes in the under surface of the wing. Internal baffles are removable for inspection of the extremities of the outer tanks.

The four Ghost DGT3 turbojets, each of 5,000 lb static thrust at 10,250 r.p.m., are housed in the wing centre section between the main spars. Their mountings are designed for rapid engine changing and other features which facilitate removal and replacement are quickly detachable air-intake and tail-pipe connections, special joints in the control rods, and good accessibility of the fuel and electrical connections. The complete under surface of the wing, in way of the turbojets, is formed of hinged panels which, when opened, completely expose the installation. There are additional access panels in the top surface, for servicing the accessories and for power-plant slinging. The installation is divided into three temperature zones, each separated by steel fireproof bulkheads and having its own ventilation and fire-extinguishing system. Fitted to the under side of the cowling is a mechanical "wipe-off" lever which, as the lowest part, will cut off fuel supply, operate the fire-extinguishing system and cut off electric power in the event of a wheel-up landing. (The nacelle layout was illustrated in *Flight* of September 29th.)



The D.H. Ghost (DGT3) of 5,000 lb static thrust. The Comet has four of these units and provision is made for two A.T.O. rocket motors.

DIMENSIONS of the D.H. COMET (Type 106).

Wing:	
Area	2,015 sq. ft.
Span	115 ft.
Root chord	29ft 6in
Tip chord	6ft 9in
Thickness/chord ratio	11%
Sweep-back at ¼ chord	20 deg
Fuselage:	
Length	93ft overall
Outside diameter	10ft 3in
Inside diameter	9ft 9in
Undercarriage:	
Track (with bogie undercarriage)	28ft 6in
Wheelbase	32ft 4in
Tail Unit:	
Span	43ft 4in
Height of fin above ground (static)	27ft 10in

The cabin pressurization system has a maximum working differential pressure of 8.25 lb/sq in, giving a cabin altitude of 8,000ft when the Comet is flying at 40,000ft. The method of pressure control provides for the selection of any desired height up to 8,000ft and any desired rate of change of cabin altitude up to the equivalent of 1,000 ft/min at sea level, provided that the permissible range of differential pressure is not exceeded. The pressure control equipment is fully duplicated and a safety valve is fitted to limit the pressure to 8.5 lb/sq in. Two inward-relief valves restrict the negative differential pressure to 0.5 lb/in.

Fresh air is supplied to the cabin from the compressors of the Ghosts and is passed through coolers (and, when necessary, through a refrigerator) before entering the fuselage. With the exception of the refrigerator the supply system in each wing is independent, and either wing can supply adequate air for pressurization. Temperature control of the coolers is automatic, with manual over-ride, but the refrigerator is switched in and out manually as required. Heat for the cabin is supplied by the compression of the air in the Ghosts.

Testing of the Comet proceeds at a healthy pace. Last Thursday, October 20th, she completed a 2,000-mile flight over Britain and Europe (as far south as Marseilles) in about four hours, cruising at 36,000—40,000ft, and a programme of still longer flights to determine fuel consumption is getting under way. By the time these words appear she may, indeed, have returned from a record-breaking trip to Castel Benito.

On Saturday evening she joined unostentatiously in the London Airport circuit and requested permission to land. Two flights ensued, the swept-wing jet taking her turn with piston-engined types of half her speed.

WALRUS versus WHALE

NO one who has read John Grierson's previous books—*Through Russia by Air, High Failure, Jet Flight*—will need reminding of the writer's entertaining, unaffected style and of his skill in weaving a thread of humour into authoritative dissertations on matters of pilotage, navigation and flight engineering.

His new book* preserves the tradition. It is the copiously illustrated account of a season's Antarctic whaling by the whale-factory ship *Balaena*, in which was made the first serious attempt to employ aircraft for reconnaissance: with a full flying and maintenance staff under Mr. Grierson's command, two Walruses were accommodated in a deck hangar and catapulted off, or flown from the sea, as weather conditions dictated.

The ship was British, but the officers and crew were almost entirely Norwegian. Though several of the harpoon-gunners of the accompanying fleet of catchers were enthusiastic about the aircrews' success in spotting whales, *Balaena's* captain seems to have been less co-operative: on many occasions, when he considered the weather unpropitious, he forbade flying; and on others, when visibility was good, he refused to stop the ship for flying-off on the plea that the hunt would be interrupted. Grierson and his English aircrews clearly became depressed by these constant "scrubbings," and their frustration is so clearly conveyed that, towards the end, the tale becomes a little depressing to read.

Enough experience was gained, however, to convince the author of the value of aircraft in whale-hunting: he thinks that the ideal machine would be the helicopter, which, suitably armed, might be used not only for reconnaissance but for the actual kill.

*"*Air Whaler,*" by John Grierson. Sampson Low, Marston and Co., Ltd., London. Price 18s.*

HUNGARIAN REVIVAL

Nationally Designed Light Aircraft and Sailplanes

DURING the war years aircraft manufacture in Hungary reached important proportions. Little original design activity, however, was undertaken, production centring on such types as the Me 109G, Me 410 and Caproni-Reggiane Re.2000. With the Russian advance, the Germans dismantled and removed all equipment and within the past year steps have been taken to recommence aircraft construction. The government is doing much to foster air-mindedness among Hungarian youth and every encouragement is being given to model-building organizations and the officially sponsored gliding and soaring centres. A considerable percentage of the gliders and sailplanes now being delivered to these centres are of national design, although the majority of club aircraft are of foreign origin.

Much is being done through the medium of the Országos Magyar Repülö Egyesület or O.M.R.E. (National Hungarian Aeronautical Association) to encourage the production of light aircraft of national design, and during the past twelve months the first results of this policy have become apparent. One of the new Hungarian light types is the R-18 Kánya, built by the Aero-Ever factory at Esztergom, on the Danube. Intended primarily as a glider-tug, it may also be built as a club machine and for army co-operation duties with the Hungarian Air Force. Looking something like a hybrid of the Fieseler Storch and the Zaunköenig, the R-18 is a high-wing monoplane with wings braced to the lower fuselage longerons by steel-tube vee struts. Slots are installed in the wing leading edges and the entire trailing edge is hinged, the inner sections acting as slotted camber-changing flaps and the outer sections as statically balanced and slotted ailerons. The fuselage is of rectangular section, tapering to an ellipse at the tail, and the cabin seats two persons in side-by-side seats.

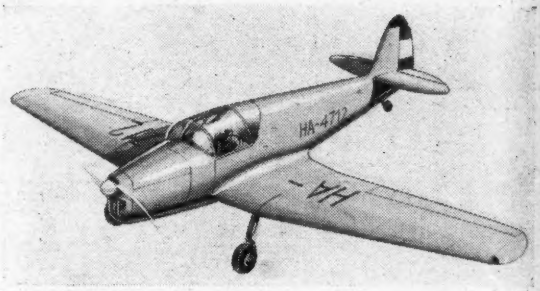
Small-field Operation

The prototype has a Walter Major engine but production machines will have a Walter Minor 6-III. The R-18 offers short take-off and slow-landing characteristics and should prove ideal for operating from small and indifferent fields. Leading particulars are: Span, 37ft 11in; length, 23ft 6in; weight empty, 904 lb; loaded weight, 1,521 lb; max. speed, 109 m.p.h.; cruising speed, 93 m.p.h.; stalling speed, 37 m.p.h.; climb to 3,280ft, 3 min; range, 370 miles.

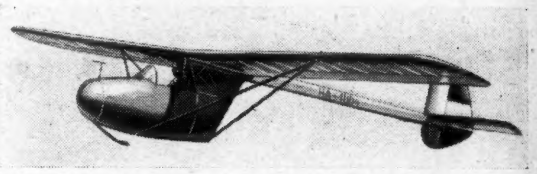
Another new light aircraft is the SG-2, which took first place in the powered category of the contest sponsored by O.M.R.E. for light sporting and training aircraft. A low-wing monoplane with a fixed, tailwheel undercarriage, this type is powered by a 105 h.p. Hirth HM 504A-2 engine. The prototype has an all-wood structure with a monocoque fuselage, but production aircraft will be of metal. Dimensions are: Span, 30ft; length, 21ft 11in; max. speeds of 136 m.p.h. and 108.7 m.p.h. respectively are anticipated.

Ernö Rubik, designer of the previously mentioned R-18, is also responsible for a number of successful gliders and sailplanes. One of these, the R-22 Futár high-performance sailplane, was Aero-Ever's first post-war product, and took second place in the 1948 Hungarian National Soaring Contest. A development, known as the Szuper-Futár, has been built for long-distance flying and is claimed to have an exceptionally good angle of glide. Other designs of Rubik include the R-15 Koma, which won the O.M.R.E. contest for a two-seat school glider, and the R-16 Lepke single-seater, completed in April this year.

The all-metal Koma is of pod-and-boom type; the fuselage is of circular cross-section, the cabin seats two persons side-by-side; and the tail surfaces are carried on a dural boom and braced to the wing by crosswires. This type is destined to become the standard two-seat training glider at all Hungarian national centres. A high-wing single-seat training glider, the Lepke may also be produced in quantity for the gliding centres. W. G.



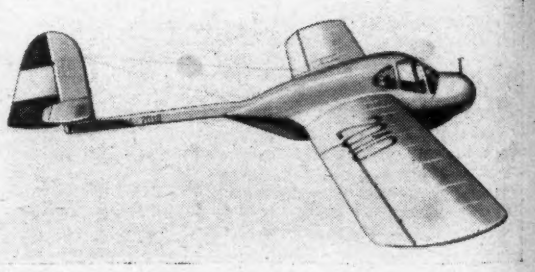
Samu-Geönczy SG-2



Lepka glider

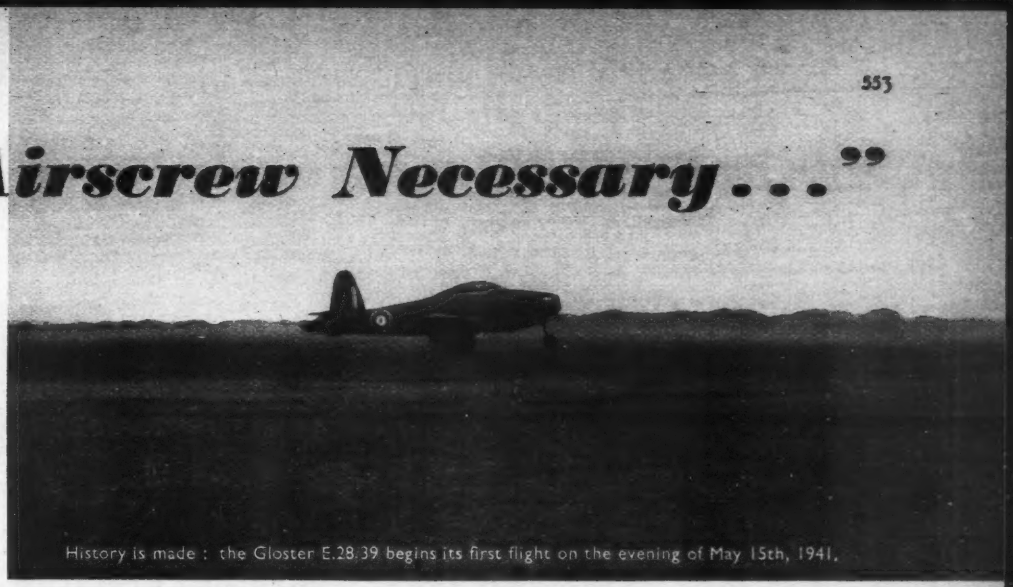
Kánya R.18 glider tug

R.22 Futár sailplane



Koma all-metal glider

"No Airscrew Necessary..."



History is made : the Gloster E.28/39 begins its first flight on the evening of May 15th, 1941.

Concerning the Gloster E.28/39, an Historic British Aircraft which Opened a New Era in Aviation

By ROBERT J. BLACKBURN

As LEADING partners in the wartime enterprise which produced the Gloster-Whittle jet aircraft, Sir Frank Whittle and Mr. George Carter are uniquely qualified to introduce a biography of that aircraft, better known, perhaps, as the Gloster E.28/39. We have invited their comments, which appear below—an inspiring and engrossing preface.

From Air Commodore Sir Frank Whittle, K.B.E., C.B., M.A., D.Sc., F.R.S., Hon. M.I.Mech.E., F.R.Ae.S.

E.28/39, like the engine which powered it, was born of sweat, toil and teamwork. From the moment when, following the first rough proposals for a small single-seater fighter to house the first engine designed for flight, Power Jets, Ltd., and Gloster Aircraft Co., Ltd., gathered round a table with Air Ministry and R.A.E. scientists to discuss the draft specification for E.28/39 just issued, the creation was a matter of continuous and close co-operation. Many weary miles were travelled between Lutterworth and Gloucester, and many weary hours spent at drawing boards and in workshops.

Tribute has already been paid to the men primarily responsible for E.28/39's design—W. G. Carter and R. W. Walker, of Glosters, and P. E. G. Sayer, their chief test pilot, who first flew her. But I should like to recall the contribution of all the craftsmen who, hampered by blackout and harried by bombs (15 feet saved E.28/39 from an incendiary during building), made that first flight—and all that has grown from it—possible.

From Mr. W. G. Carter, C.B.E., F.R.Ae.S.

My introduction to the jet engine took place in September, 1939, when asked by the Air Ministry if we would take on the job of designing a jet-propelled aeroplane. I went to renew my acquaintance with Frank Whittle at Power Jets and to see his engine at work. After some preliminary talk and a look over a few of the drawings, we went along to the test bay, and I had my first sight of a gas-turbine-cum-jet-propulsion unit. It seemed to me to be a quaint sort of contraption—rather on the rough and ready side—and by no means the kind of thing to inspire confidence as a prospective power installation.

It started working with a characteristic muffled thud as the fuel mixture was ignited, and was quickly speeded up to register a modest amount of thrust, which to the best of my recollection was about 400 lb. Some parts of the engine casing showed a dull red heat which, combined with an intensely high-pitched volume of noise, made it seem as though the engine might at any moment disintegrate in bits and pieces. However, I could regard the event as no other than an unforgettable and unique experience, and felt convinced that the prospect of ultimately successful development of the engine far outweighed the very hazardous nature of the enterprise in accepting responsibility for putting it inside an aeroplane. The design of an experimental aircraft known as the Gloster E.28/39 was soon under way. It was based on the then almost unexplored region of high subsonic speed, and rightly regarded by the Gloster, Power Jets and R.A.E. teams as a very intriguing proposition. The series of outstandingly successful test flights which commenced in May, 1941, was looked upon by all concerned as a most fitting reward for the work which had been done.

IT seems certain that the future path of aviation progress will bear no single technical milestone to match jet propulsion, either in the depth of achievement behind it or in the broadness of possibilities ahead. Surveying present developments, no doubt can be felt concerning the decisive effect of British skill and enterprise; the work of the jet propulsion pioneers in Great Britain eclipsed all previous and contemporary endeavour in this field—a fact which history will confirm without question.

With a sense of the deep historical and technical interest of the subject, we have welcomed the opportunity of placing on permanent record the story of the conception and development of the first practical jet-propelled aircraft—the Gloster E.28/39. During the working life of this unique instrument of research, wartime security forbade the possibility of reporting the machine's progress. Now, largely with the assistance of original flight-test reports placed at our disposal by the Gloster Aircraft Company, the following account has been prepared.

In establishing the status of the E.28 as the first success-

"No Airscrew Necessary . . ."

ful jet-propelled aircraft, two previous claimants to this proud position must first be mentioned. On August 27th, 1939, the Heinkel He 178 made its first flight, but the He S.3 turbojet installed in it gave serious trouble, and further German jet flight development, retarded by metallurgical problems, was not resumed until after the Gloster machine had appeared. The Italian Caproni-Campini C.C.2, first airborne in August, 1940, did have a form of jet-propulsion, but instead of the turbine of the true turbojet, it had an in-line piston engine as a power source for the compressor. Although a novel design, it showed no great technical advance and its performance was poor.

The uphill pre-war progress of Sir Frank Whittle's company—Power Jets, Ltd.—is a story outside the province of this article, but a "flashback" to 1938 will recall the conception of the Gloster-Whittle venture. On March 18th of that year Power Jets received the first development contract from the Air Ministry—a crowning and encouraging moment after ten years of research, with signs of success appearing only by gradual stages. Just over a year later, on July 7th, 1939, the Ministry placed an order for the first flight unit, designated W1, and shortly afterwards began discussions with the Gloster Aircraft Company concerning the design and construction of a fighter aircraft to test this new means of propulsion.

The contract for this type, the E.28/39, was placed on February 3rd, 1940, and envisaged a four-gun, 380-m.p.h. fighter, powered by a unit of 1,200 lb static thrust. Its primary object, stated the contract, "will be to flight-test the engine installation, but the design shall be based on requirements for a fixed-gun intercepter. . . ." Guns and

Theories proved: on successful completion of the first flight, Whittle congratulates Britain's first jet pilot, the late F/L. Sayer,

ammunition were not demanded for initial flight trials, however, and, in fact, were never fitted.

The subsequent work of the Gloster design team at Brockworth, headed by Mr. George Carter, was undertaken with the closest co-operation of Power Jets, whose engine testing and development continued in an old foundry at Lutterworth, rented from the British Thomson-Houston Company. The B.T.H. concern was responsible for the drawings and construction of the W1 turbojet, and had played an integral part in gas-turbine research since 1936. Flight Lieutenant W. E. P. Johnson, now managing director of Power Jets (Research and Development), Ltd., supervised installation, and was responsible for the liaison between makers of the power unit and the airframe.

Two E.28s were under construction, and as the first—registered W 4041—neared completion, it was transferred from the Gloster works at Brockworth to a garage at Cheltenham to lessen the chances of destruction in an air raid. Meanwhile, construction of the W1 was proceeding. Some of the components made for it had been deemed unairworthy and, together with a number of spare components, were combined to form an early version—the W1X. Preliminary tests were made on this unit, showing that performance, while not fully up to expectations, was greatly in advance of that of the earlier Whittle designs. To conserve the W1, it was decided to install the unairworthy W1X in the E.28 for taxying trials.

Early in April, 1941, the aircraft was taken to Brockworth for these initial tests. Completed, the E.28 was seen to be a complete breakaway from the accepted formula for fighter design. As events proved, its appearance was an earnest of later developments. Fuselage design presented a major problem, and in order that the risks involved by the very nature of the work should not be increased, a simple "straight-through" power installation was adopted. The turbojet was positioned in the rear fuselage, and its tail-pipe carried through to the extreme tail; in the nose was a circular intake split into two ducts which followed the fuselage sides to the plenum chamber. Supported at four points on a tubular engine-bearer frame, the W1 itself had ten combustion chambers of the reverse-flow type, to which air was fed by a double-sided, aluminium-alloy centrifugal compressor; paraffin was injected by ten Lubbock burners, and the products of combustion energized a single-stage, axial-flow turbine. The turbine's 72 blades employed, for the first time, the "fir-tree" method of root fixing. The rear bearing was cooled by liquid which circulated through two radiators mounted in the air intake ducts; in practice, one of the radiators was blanked off from the coolant circuit, and the rear bearing was eventually cooled by air from the compressor in place of liquid. At its maximum permitted r.p.m. of 16,500 (above 4,000ft this figure was increased to 17,750), the W1 produced 860 lb thrust.

Of all-metal, monocoque construction, the fuselage was covered with light-alloy stressed skin. An 81-gallon fuel tank was fitted between the turbojet and the forward-placed

SECRET

A GLOSTER AIRCRAFT CO. LTD.

TEST FLIGHT REPORT No.: 1

PILOT P.E.G.Sayer.

Type of Test: 1st Flight. General experience of the type.

Time and Time of Start 15.5.41. 1040 hrs. Duration 17 mins.

AIRCRAFT: Type and No. E.28/39. W.4041.
Type of Undercarriage Dowty nose wheel type. All retractable.
Other Features Main wheel lever suspension type. Nose wheel strut type.

AIRSCREW: Type and No. No airscrew fitted with this method of propulsion.
Dia.:
Fine Setting Pos Coarse
Ground Clearance Flying Position Tail on Ground

ENGINE: Type and No. Whittle Supercharger Type W.1.
Reduction Gear
R.P.M. G.G. Fine Pitch 16800 Take-off. Coarse Pitch
Boost G.G. " " " "
Type of Air Intake
Radiator 3rd radiator blanked off. Port radiator in circuit.
Other Features

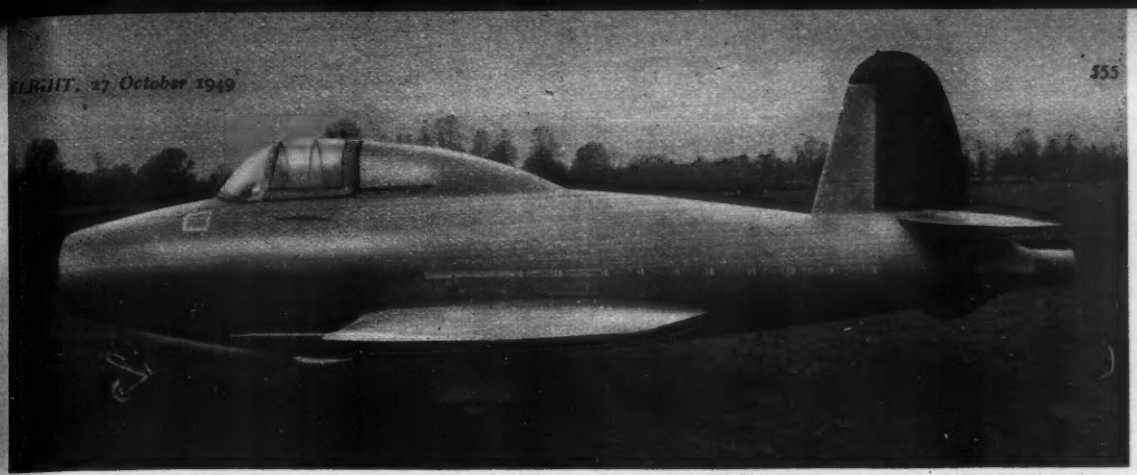
WEIGHTS CARRIED: Speed Paraffin 80 galls. Oil 1 gall.
Cooling Liquid 3.5 galls water.
Total Weight 5441 lb. estimated from Swinged.B.
C.G. Position .896 A.M.G. W/C Down. .897 A.M.G. W/C Up calculated from (Tare C.G.
Loading Sht. No. 148 Dem 7.5.41.

REMARKS:
Nose wheel leg total travel 18" as against 10" on original nose wheel leg fitted for taxying trials at Brockworth. Static travel 6" instead of 7" on the first leg.
Nose wheel strut pressure reduced from 140 lbsq.in. to 115 lbsq.in. Tyre pressure reduced from 90 lbsq.in. to 80 lbsq.in.
Steering on nose wheel 11° either side of the centre line
Brakes on all three wheels.

TEST INSTRUMENTS:
Alt. Attenuator No.: Calibrated
A.S.I. Instrument No.: " "
R.P.M. " " " "
Boost Gauge " " " "
Air Temp. " " " "

Signature of Pilot P.E.G. Sayer(L).

(Left) A facsimile of the first page of flight-test report No. 1.



Visible in this side view are paint-strips on the E.28's fuselage for assessment of skin temperatures. The first flight dispelled many fears as to the "dire effects" of the tremendous heat generated by the power-unit.

cockpit which, incidentally, had a rearward-sliding hood. The mainplanes were stressed-skin-covered, two-spar, cantilever structures, tapering in chord and thickness; with a single joint on the fuselage axis; the wing was recessed into the underside of the fuselage. Fabric-covered ailerons, with automatic balance-tabs, were fitted, and the split, trailing-edge flaps were hydraulically operated through a hand-pump in the cockpit. For the first series of flight-tests, the aerofoil was of 230-Series section, but all further tests were made with "high-speed," G.W.2-section wings.

Largely to ensure good take-off characteristics, the E.28 had a nosewheel undercarriage (it was one of the first fighters so equipped) which took full advantage of the low ground-clearance possible in the absence of an airscrew. Of Dowty design, the undercarriage comprised a steerable, telescopic-strut nosewheel which retracted backwards, and two knee-action mainwheels retracting sideways and inwards into the wing. All three units had brakes and oleo-pneumatic shock-absorbers. Retraction was effected by hydraulic pressure, the accumulator normally being charged manually before flight. To compensate for the loss of airscrew slip-stream effect at low air-speeds, the elevator was of particularly generous area.

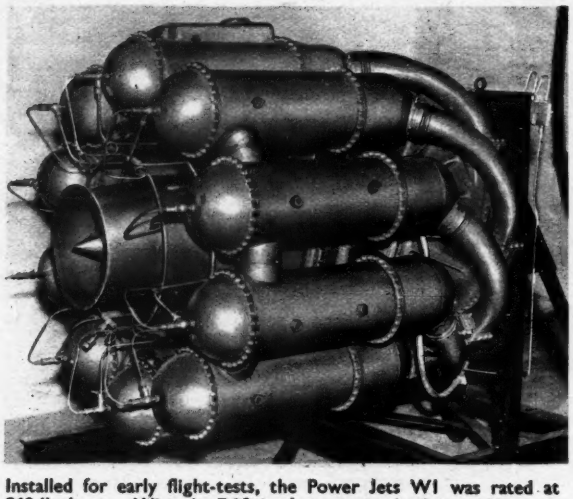
A moment's digression will give some indication of the foresight shown in the Gloster design office. In November, 1940, the Air Ministry, expressing increased faith in an untried means of power, issued a specification, F. 9/40, for a twin-jet, single-seat fighter, which, of course, finally emerged as the highly successful Meteor. Twelve examples were ordered in February, 1941. In the same month, records speak of a minute from Carter to Whittle expressing concern that "extrapolated thrust at 60,000ft appeared to be zero," as this affected the bomber programme. At this time, be it stressed, three months were to elapse before the first British jet aircraft left the ground.

Late in the evening of April 7th, Gloster's chief test pilot, the late F/L. P. E. G. ("Jerry") Sayer, began taxying the E.28 on the soft grass surface of Brockworth airfield where, he reported, 10,000 of the 13,000 r.p.m. permitted were needed before there was enough urge to move the aircraft. Before darkness concluded the test, the pilot found controllability very good; but acceleration poor. This showed improvement the following day, when the unairworthy W1X turbojet was allowed to rotate at 16,000 r.p.m. In the second of two taxying tests then made, the E.28 made three short "hops," each of some 100-200yd, at a height of about 6ft, preceded by take-off runs of some 600-700yd. Control during these short periods in the air was reported to be good, and almost the only adverse comments referred to acceleration and adjustment of the throttle control. During the afternoon of May 8th, Sir Frank (then W/C.) Whittle took over from Jerry Sayer and himself taxied the aircraft for brief periods. On the first page of Sayer's report of the initial taxying trials, against the heading "Airscrew," appears an historic remark—"No airscrew necessary with this method of propulsion." Words to this effect recur in several successive reports, strictly accurate, and yet hinting at the satisfaction justly felt during this unique period.

Cranwell, with its long runway, was chosen as the airfield from which the E.28 would make its first flights. Before the journey by road to Cranwell, where further taxying tests took place on May 14th, the W1 power unit was installed, having received clearance for 10 hours' flying, and a number of minor adjustments were made to the aircraft. On the smoother airfield surface, acceleration was found to be greatly improved. The nosewheel steering was so effective that Sayer recommended that brakes be used only for slowing-up the taxi- or landing-run. Heavy rain prevented him from experiencing further "hops," but he established that the best pre-take-off procedure was to reach full r.p.m. against the brakes, now practised almost exclusively with jet aircraft.

Sound operational considerations aside, Cranwell remains the scene most historically suitable for the beginning of this great venture. As the home of the Royal Air Force College, it was the cradle of Whittle's earliest theories concerning jet propulsion, and the starting-point for the engi-

Showing the bifurcated air intake in the nose, low-clearance undercarriage and neat overall appearance of the E.28.



Installed for early flight-tests, the Power Jets W1 was rated at 860 lb thrust. With the E.28, it now rests in the Science Museum.

"No Airscrew Necessary . . ."

neering training which he has since described as a major contributing factor towards his work. And so, on May 15th, 1941, Frank Whittle returned to Cranwell to witness the historic moment, the climax to a story which had begun with his admission to the School of Technical Training as an apprentice 18 years earlier. With him were George Carter and a number of representatives of the Gloster Company and Power Jets, Ltd.

Not until 7.40 in the evening did the weather permit Jerry Sayer to begin the first flight. Unemotional and precise, the subsequent report was like all Sayer's work, an example of the finest type of test-flying. With cockpit hood open, it records, the aircraft was held on the runway into a westerly wind and run-up to 16,500 r.p.m. before the take-off. Flaps were fully up and, as the aircraft's nose had tended to rise as soon as it was airborne during the Brockworth tests, elevator trim was set to give a slight forward load on the control column. Brakes were released, and acceleration appeared quite rapid; with feet off the rudder bar, the pilot found no tendency to swing. He took off "purely on the feel of the elevators and not on the air speed", after a run of 600-700 yd, and although fore-and-aft control was very sensitive at very small movements, the flight was continued. Until the undercarriage was raised at 1,000ft, the rate of climb, for which r.p.m. were reduced to 16,000, proved to be slow. Sayer found the engine to be "quite smooth", while the noise in the cockpit "resembled a high-pitched turbine whine". In gentle turns, the aircraft "behaved normally", and the ailerons were described as being light and responsive. Flaps were lowered on 100 m.p.h. indicated, and the aircraft was trimmed to glide at 90 m.p.h. I.A.S. The landing approach, made in gentle gliding turns, showed good controllability, and the E.28 touched down slightly on the mainwheels first, going gently forward on to the nosewheel.

During this flight of 17 minutes, therefore, the propulsion unit behaved perfectly, and only minor trouble was caused by a few airframe "snags"—over-sensitive elevators, a low port wing, a faulty undercarriage indicator light, and a delay in dropping the nosewheel. An inspiring success, this first flight clearly demonstrated the good effect to which the designers of both airframe and power unit had calculated. Even among "well-informed circles" there had been most pessimistic predictions as to the results of employing this revolutionary form of power—to the effect that the E.28 would behave like a rocket without a stick, or that excessive heat would burn off the tail unit.

During the next 13 days, 14 further flights were made, all successfully, which brought flying time up to the 10-hour mark. By degrees, the aircraft was flown at altitudes up to 25,000ft, an indicated air-speed of 300 m.p.h. was recorded, and control characteristics generally were found to be good. Flying with its full tankage of 81 gallons, and at an all-up weight of 3,690 lb, endurances as great as 56 minutes were recorded. Jerry Sayer pointed out, however, that not more than 2g could be applied to the aircraft, due to the low stressing of the W1 compressor casing. Consequently, "it must therefore be realised that the aerodynamic development cannot be completed until it is possible to carry out full fighter manœuvrability and dives on this type, and so determine any difference in flying characteristics with this method of propulsion as compared with the normal aeroplane".

Meanwhile, at Lutterworth, Power Jets were at work on more powerful turbojets. Drawings of one of their designs, the W2B, were sent to America in the autumn of 1947, together with the original W1X which had taken the E.28 through its taxying tests. General Electric production versions of the latter type, slightly modified, were installed in the Bell P-59 Airacomet, America's first jet aircraft, which made its initial flight on October 1st, 1942. The W2B (which was virtually the prototype Welland, as fitted to the early Meteors, and is thus succeeded today by the Derwent and Nene), also formed the basis of further G.E. turbojets.

Certain features of the W2 were incorporated, for early flight-testing in the W1A turbojet, an improved version of the W1, installed in the E.28 for the second series of tests, which began at Edgehill, Warwickshire, on February 16th, 1942. To reduce automatically the fuel flow in accordance with decreased atmospheric pressure at altitude, the W1A was fitted with a barostat. During all further tests, the airframe suffered a major "mod", by acquiring the high-speed, thin-section wings, but the only noticeable effect on performance was a 4 m.p.h. higher stalling speed. After the sixth flight of the series, a check on level speed at 5,000ft, the first turbojet troubles began to appear. Inspection showed the exhaust cone to have wrinkled, and the turbine clearance to have dropped below safety limits. Power Jets rectified these points within ten days, and testing was resumed.

Blade Breakage

The eighth flight, on March 24th, was to have been a climb to 30,000ft, but early in the ascent, Sayer noticed "a very sudden change of note, followed by serious engine vibration". Keeping the revs down to 10,000, he returned to Edgehill, where one turbine blade was found to have broken in half, damaging adjacent blades. After repairs, a second attempt was made on June 2nd, but a sticking relay piston in the barostat caused loss of power at altitude. With this component removed from the fuel system, tests were resumed on June 6th, when occurred the first complete power unit failure. After climbing to 30,000ft in 28 minutes, Sayer began a level speed run, but after less than two minutes roughness was felt, and almost immediately the "fire" went out. The pilot's report stated that a "forced landing was carried out from 30,000ft on Edgehill Aerodrome and no damage was done to the airframe". It concluded that the failure was due to "oil starvation to the gearbox and front and rear bearings. The oil in the oil feed pipe congealed and so restricted the oil flow to these parts. Some rapid development is required on the oil system to overcome this trouble, followed by more high-altitude flight trials, particularly as the installation on the F.9/40 is even more exposed than on the E.28/39".

Sayer's analysis proved correct, and a new W1A was supplied by Power Jets with an oil system, known as the "ring-main," modified to prevent freezing at high altitudes. Further troubles lay ahead, however, for on the next flight (on September 27th), "immediately after take-off the high oil pressure commenced to fall although the low oil pressure still indicated 8 lb/sq in. The aeroplane was held down after take-off in order to gain speed in case of engine failure. Before commencing a turn to land back on the aerodrome, the high oil pressure had dropped to 5 lb/sq in from 34 lb/sq in on the ground run. The engine was throttled back as much as possible to regain the aerodrome with the high pressure oil still indicating 5 lb/sq in

only, and the low oil pressure indicating 8 lb/sq in, with a tank and scavenge oil temperature of 33 deg C. The aeroplane was landed back on the aerodrome but unfortunately the port wing tip touched the ground and slightly damaged the bottom skin."

Jerry Sayer never flew the aircraft again. He was lost in a Typhoon just over three weeks later, while practising dummy attacks with an R.A.F. squadron pilot. Neither aircraft returned from this flight, and it was presumed that they collided. F/L. P. E. G. Sayer, O.B.E., had been chief test pilot of the Gloster Aircraft Company since 1934, and had previously been assistant test pilot to "George" Bulman at Hawker's since 1930. A man remembered for his great personal charm, he was one of the finest British test pilots of all time.

His assistant, Michael Daunt, had not previously flown the E.28, but as soon as it was ready for flight, on November 6th, he began a series of three handling flights. He noted an excess of friction in the controls, and some undercarriage vibration, but otherwise his main impression was one of "ease of handling and confidence in the ability to pull off a forced landing if so desired." His next flight was the first test of the new oil system, and involved a close study of pressures and temperatures between 5,000 and 10,000ft.

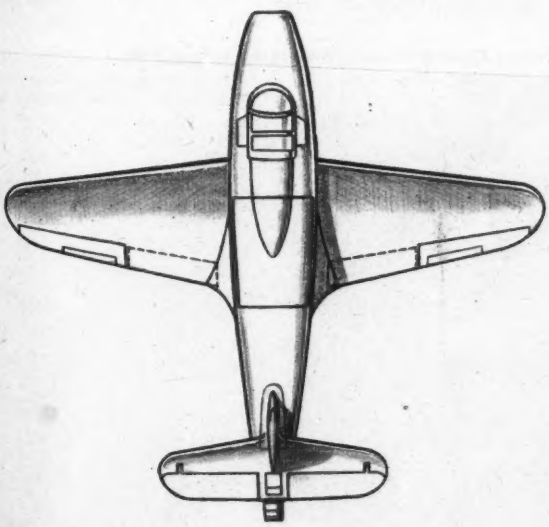
Pioneers: the four Gloster test pilots responsible for flight-testing the two E.28 prototypes. The late P. E. G. Sayer (in E.28 cockpit) was succeeded by Michael Daunt (top right) and his assistants—John Crosby Warren (in Typhoon) and John Grierson (below left).

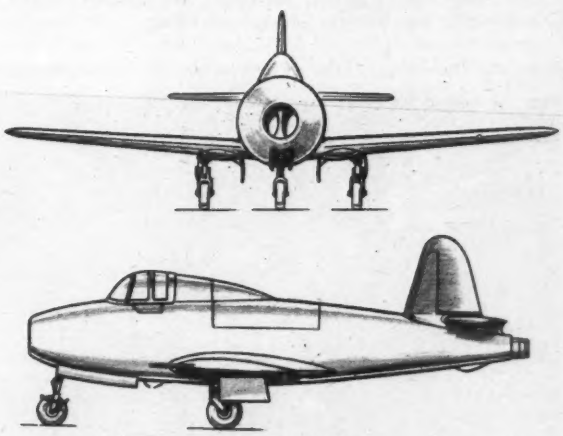
A further delay occurred while the E.28 was transferred to the Royal Aircraft Establishment for continuation of this third series of tests. A brief note at the end of Daunt's first report from Farnborough, on November 12th, records the name of the first Service pilot to fly a jet aircraft: he was W/C. H. J. Wilson, later Group Captain, and the pilot who, in 1945, established for Britain a world's speed record of 606 m.p.h. in a Meteor. During the last few days of 1942, Michael Daunt finally proved the success of the "ring-main" system, which involved lagging, and increasing the bore of the oil pipes. His last flight on the E.28 before it was handed over to Service test pilots, took place on December 29th, after which he noted that, at 25,000ft, although other aircraft at this height were producing vapour trails, at no time during the flight was a trail observed.

The second E.28/39 prototype, W4046, now enters the picture. It was fitted with the Power Jets W2B, a more powerful unit which, designed at Lutterworth, was thereupon passed on to a number of firms by now engaged in turbojet research and construction. As mentioned previously, the W2B was the basis of the Welland, and a number of General Electric designs. Early in 1940, the Rover Car Company began work towards both production and development of Power Jets designs (and eventually initiated the change-over from the "reverse-flow" to the "straight-through" combustion system, as exemplified by all successive centrifugal-compressor turbojets), and it was, in fact, a Rover-built W2B, bearing the makers' classification B23, which powered W4046. In final form, the thrust of this unit rose from its original 1,000 lb to 1,700 lb.

The new E.28 was ready for its first flight on March 1st, 1943. A third Gloster pilot, John Grierson, undertook initial development of W4046; meanwhile, Michael Daunt prepared to make the first flight of Gloster's next venture, the F.9/40. Grierson's summary of twelve flights made within a fortnight is of particular interest, in that his impressions were not only those of an experienced pilot, but also of a noted author. (Among his works, *Jet Flight*, published in 1945, is a splendid first-hand impression of the background to British wartime turbojet progress. We gladly acknowledge this book as a source of reference for a number of otherwise unrecorded details in the story of the E.28.)

Enthusiastically, John Grierson wrote: "The very favourable impressions of jet propulsion obtained . . . have all been endorsed by subsequent flights. . . . The E.28 is a most pleasant little aeroplane to handle, particularly on account of the excellent field of vision from the pilot's seat,





GLOSTER E.28/39

Span	29ft
Length	25ft 3in
Height...	9ft 3in

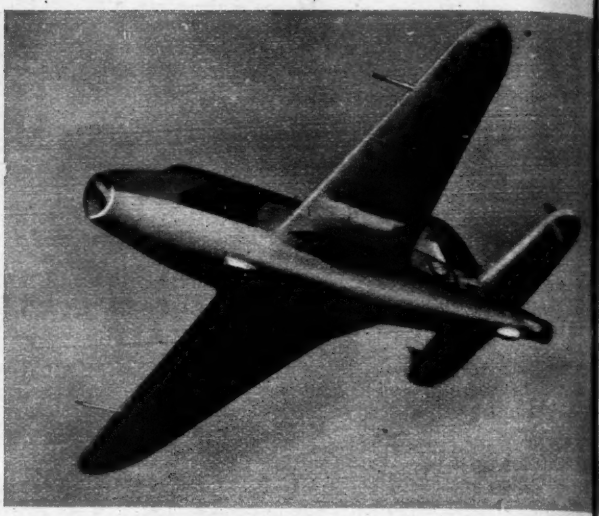
"No Airscrew Necessary . . ."

and because the ailerons, the most difficult controls to design and the ones of greatest importance from the point of view of manœuvre, seem to have set a new standard of lightness and positiveness. . . ."

Elevators and throttle control evoked minor criticisms but with the latter "the main point is that here we have a lever which banishes once and for all the airscrew speed-control, the mixture-control, the supercharger change-gear control, the hot- and cold-air intake control, and the gill or radiator controls and gives the pilot one lever and one lever only with which to regulate his engine. . . . Jet propulsion brings us back to a simplicity in engine control which has been unknown since the flight of the Wright Brothers." He concluded that "with the jet-propulsion engines becoming available there is every reasonable prospect of not only equalling but of beating by a substantial margin the speed of the fastest airscrew-driven machines." Grierson shared flight development of the W2B-powered E.28 with the late John Crosby Warren, who was killed in 1944 flying a prototype Meteor. After his fourth flight, this pilot commented on smoothness of flight —"There seems to be no sign or sound of aerodynamic burble under any engine condition up to 360 m.ph. . . . the ease with which the aircraft slides through the air is amazing." Prophetically, he concluded: "For ordinary flying it may be necessary to provide flaps which can be operated at higher air speeds than those normally fitted to conventional engine/airscrew machines, to enable pilots to lose speed more easily."

Rolls-Royce took over further development of the W2B —now producing 1,400 lb thrust—in April. On the 17th of that month Grierson made the first British cross-country jet flight, on W4046, from Edgehill to Hatfield. There, in the hands of Michael Daunt, it was demonstrated "in front of the Prime Minister and various officials of the Air Staff." Of the ferry flight back to Edgehill, Daunt recorded that it was made "at 6,000ft at approximately 14,000 r.p.m., at which engine condition the aircraft cruised at an indicated air-speed of 260 . . . accompanied by an escort of two Spitfires who stated that this seemed to be a rather fast cruising speed for their aircraft."

W4046 was taken to Farnborough shortly afterwards where, with a new W2B of 1,526 lb thrust, it reached its greatest speed of 466 m.p.h. On July 30th, while on a high-altitude test, its ailerons jammed and the pilot, the late S/L. D. Davie, baled out safely from 33,000ft. The original and sole remaining E.28/39 had earlier been returned to Brockworth for the installation of the Power Jets W2/500, which gave 1,700 lb thrust. Michael Daunt began Gloster's flight development of the rejuvenated "4041" and found the new turbojet "the smoothest unit that this pilot has had the pleasure of flying." To ensure

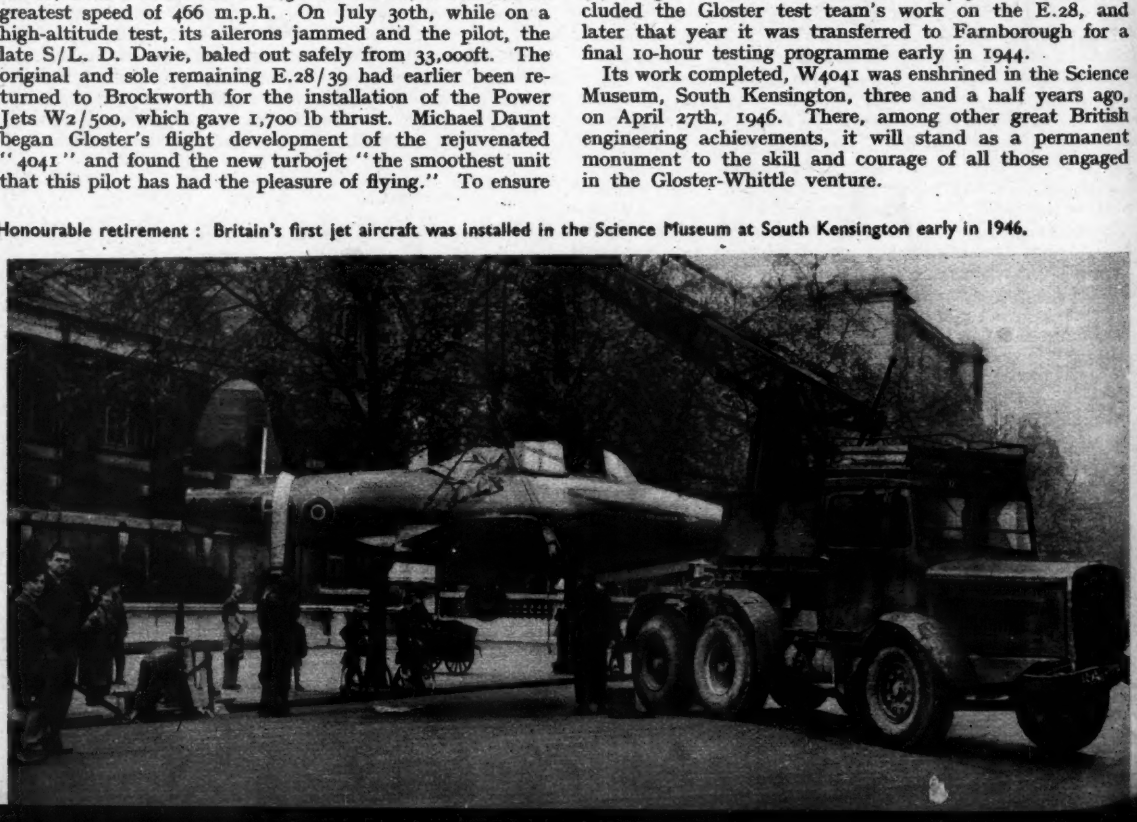


One of the few existing air photographs of the E.28/39. The small fins on the tailplane were added during test at Farnborough.

collection of the maximum possible operating data at high altitudes, the aircraft now carried an automatic observer. During this series of flights, made largely by John Grierson, a vapour trail—possibly the first made by a jet aircraft—was seen to come from the E.28 at 35,000ft. This flight on June 4th, was curtailed by the appearance of cracks in the transparent canopy. On June 24th, 1943, the greatest height of 42,170ft above sea level was attained. Grierson took off before breakfast, after inhaling pure oxygen for the previous 30 minutes; the E28 cockpit was unpressurized, but he wore a pressure waistcoat. He reached an indicated altitude of 41,600ft in 27 minutes, but had to abandon an intended check of level speed at this height due to fuel shortage. Apart from intense cold, the pilot found "no physical discomfort whatever" but "this flight does seem to underline the need for (a) adequate cockpit heating, and (b) 100-gallon fuel tank." The next day John Warren concluded the Gloster test team's work on the E.28, and later that year it was transferred to Farnborough for a final 10-hour testing programme early in 1944.

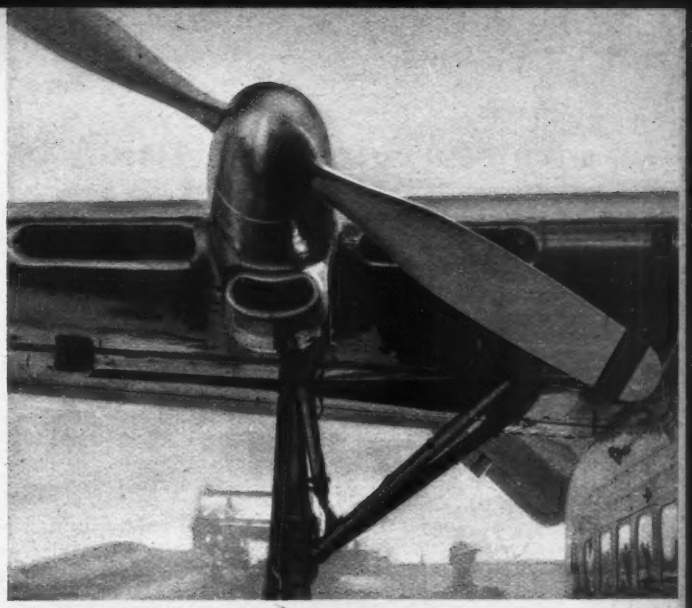
Its work completed, W4041 was enshrined in the Science Museum, South Kensington, three and a half years ago, on April 27th, 1946. There, among other great British engineering achievements, it will stand as a permanent monument to the skill and courage of all those engaged in the Gloster-Whittle venture.

Honourable retirement: Britain's first jet aircraft was installed in the Science Museum at South Kensington early in 1946.



BEECH TWIN-QUAD POWER PLANT

American Arrangement for Coupled Engines



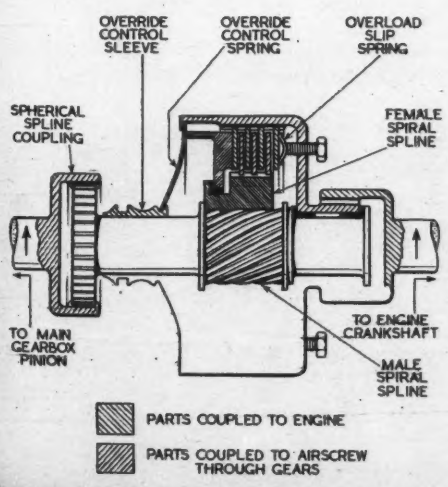
This exterior view of the Twin-Quad installation shows the clean lines permitted by such an arrangement, and gives a deceptive impression of the aircraft's being "underpowered".

IN the light of recent British developments with paired and coupled-engine installations, the advantages of which have been known to designers for many years, the approach to the problem adopted by the Beech Aircraft Corporation in their development of the Model 34 Twin-Quad, a 14-20-seater feeder-line aircraft, is of interest. Mr. T. A. Wells, Beech's Chief Engineer, and Mr. J. W. Massey, Test Engineer, were primarily responsible for its development.

The American installation differs mainly from the British methods in that, unlike the angular or side-by-side disposition of engines used in the Brabazon I and Fairey 17 respectively, and the arrangement proposed for the Saro Princess, the small coupled Lycomings of the Twin-Quad are horizontally opposed with their axes parallel to the main spar. Each pair of engines is coupled to drive a single airscrew, rather than the coaxially arranged double airscrews favoured in British designs. A brief description of the Twin-Quad's aerodynamic characteristics, evolved as the result of over 100 flight tests, is necessary in order to understand the various considerations which have governed the arrangement of this installation.

It is generally accepted that an essential characteristic of any four-engined aircraft is that it should be able to continue take-off and climb with one airscrew windmilling in the event of an engine failure; this problem is, of course, non-existent in the Twin-Quad, as the single airscrew continues to be driven by the remaining "live" engine, thus relieving the crew of the necessity for identifying and feathering the inoperative one. Tests have shown that when the Twin-Quad "loses" an engine there actually remains more than three-quarters of its available thrust power, as opposed to less than three-quarters thrust horsepower for the same condition in a conventional four-engined aircraft. This is due to the extra power required to overcome the drag which is still produced although the airscrew is in a feathered condition. Beech also claim that the minimum safe air speed is considerably lower than that of an equivalent four-engined aircraft flying on only three engines. Use of the horizontally opposed installation also permits complete submergence of the engines within the wing, thus materially reducing the parasitic drag and aerofoil disturbances usually associated with normal engine nacelles.

The clutch is shown in the disengaged position. Rotation of the crankshaft causes the engaging splines to move towards the engine, thus compressing the clutch discs to provide a direct drive.



The general relation of the main components of a Twin-Quad power plant, as developed to date, are shown overleaf. They consist of two 400 b.h.p. engines (standard Lycoming GSO-580s), two clutch assemblies, main gear box, drive shaft, nose assembly and the airscrew. The clutches are arranged to drive bevel pinions through annular splined couplings which permit movement of the engines in their rubber mounting. Inside the main gear box the bevel pinions mesh with the main input gear on the transmission shaft, and the gear box itself is rigidly mounted in the wing structure. Drives for ancillary equipment such as generator, starter, governor, oil pressure- and scavenge-pumps are provided by spur gears driven from a spur pinion carried on the main spiral bevel gear. The two multiple disc clutches provide direct connection between the engines and the main gear box pinions. Axial force necessary to compress the discs in order to provide a direct coupling to the airscrew is derived from the action of engine torque on a spiral spline. In order to avoid damage to the drive system from shock loads the torque transmitted by the clutch is limited by an adjustable stop. If engine torque fails altogether the spiral splines act in reverse, separating the clutch discs and disengaging the dead engine without affecting the drive from the live one; automatic re-engagement occurs if the engine again becomes operative.

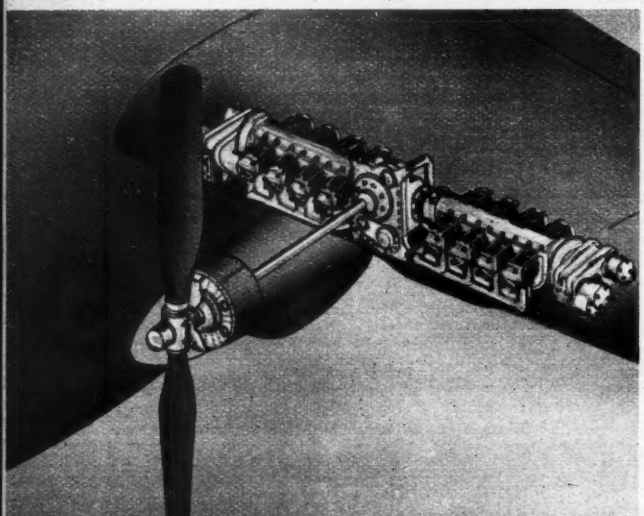
In order to ensure a "flywheel" action during conditions of starting, idling and gliding, a mechanical override is provided which is operated electrically by changes in engine manifold pressure. With this arrangement the clutch is in the "automatic disengage" position under all powered flight conditions, and the clutches are mechanically locked so as to transmit torque in either direction when operating at or near "closed-throttle." The whole transmission, including the nose assembly, is pressure-lubricated by a dry-sump system—two spray jets being incorporated to cool and lubricate the spiral bevel gears. Both the airscrew shaft, which, incidentally, also drives the nose-

BEECH TWIN-QUAD POWER PLANT . . .

housing scavenge-pump, and the Hamilton Hydromatic airscrew are of standard design.

A salient feature of the installation is that, like its British counterparts, the ancillary equipment is, wherever possible, incorporated in the transmission, and as it is unnecessary to disturb airscrew or governor controls, a complete engine change may be effected in approximately two hours.

The basic development of the type of transmission in use to-day began in 1943, with a similar configuration for an aircraft with a single "double" engine. This was never built, however, and testing of the transmission for the Twin-Quad design did not take place until late 1946. The first part of the programme was devoted to finding the most suitable bearing and clutch-plate materials, and in order to reduce weight, aluminium-tin was chosen. This material, however, was found to be unsatisfactory for use in thrust bearings and, consequently, all bearings carrying heavy



Installation within the wing is shown in this cutaway drawing.

thrust loads were redesigned as ball-type bearings, aluminium-tin being retained for the journal bearings only. A test stand, with an unsupercharged engine, was then rigged and a very important aspect of the problem—that of malfunction of the engine—was investigated. No device had as yet been provided to absorb the shock loads which would result when an engine engaged itself suddenly, and this condition sometimes resulted in failure of some part of the system. As a result of using supercharged engines and a larger number of clutch plates the tendency to engage or disengage when an engine was not firing properly was practically eliminated, but, nevertheless, an exhaustive test was made to discover the weakest components in the transmission. Following a drive-shaft failure it was found necessary to limit the torque by fitting a heavy adjustable spring to oppose axial forces on the clutch plates; the resulting transmission, although designed to prevent shock loads, was, therefore, capable of absorbing them should they occur accidentally. C.A.A. approval for the installation was gained after an extremely severe test, equivalent of three 150-hr running periods.

The Beechcraft Model 34 Twin-Quad in the air. Apart from a typical "Bonanza" tail-unit, a similarity to the general form of the "Mamba" Marathon is discernible.

As a result of their long testing programme, Beech designers established a number of requirements which, in their opinion, should be fulfilled by any system using two or more engines to drive a single airscrew.

These were that: (1) A failed engine should automatically disengage itself from the airscrew and the remaining live engine, but this uncoupling should not be so rapid as to be caused by a minor misfire of the engine. (2) Provision should be made to ensure that the engine continues to run under closed-throttle or very low power conditions, which means that a "flywheel" action should be provided, to be achieved either by "coupling" the engine directly to the airscrew or by using separate "flywheels." (As the use of "flywheels" is impractical from the point of view of weight, and in the idling condition is inclined to be unreliable, it was found advantageous to resort to the original idea of direct coupling of the clutch to the airscrew. (3) Provision should be made for the restarting of a dead engine in flight. (4) If an engine disengages itself for any reason it must re-engage automatically when its speed equals that of the other engine. (5) The entire transmission system must be stressed to withstand the shock loads of sudden engagement of the clutch. (6) The complete power plant should be designed to avoid torsional vibration in the speed range of both single and twin-engined operation and in any possible power-phasing relation between the two engines. If such resonance could not be avoided, then components should be capable of withstanding the resultant loads.

In the Twin-Quad installation the makers claim to have fulfilled these requirements by their successful development of the automatic clutch mechanism (a sectional diagram of which is reproduced to show method of operation), and by the use of components capable of withstanding the occurrence of severe torsional vibration.

Such an installation would appear to have certain advantages over the co-axial-drive paired power-plants as designed in this country, particularly in the case of engine failure, when the Twin-Quad's pilot need do nothing more than shut off the fuel supply to the dead engine. It will be interesting to follow the progress of this design now that it has received C.A.A. approval, and to see whether the aircraft can, in fact, substantiate the advantages in performance which it claims over conventional four-engined aircraft in a similar power and dimensional category.

The two multiple-disc clutches for each power plant, housed complete with their override assemblies in cast magnesium casings, are of identical design.

CIVIL AVIATION NEWS

SCENIC CIRCUIT: Innsbrück airfield, in the French Zone of Austria, has a picturesque if somewhat formidable setting. In traditional Tyrolean style, the hangars and control tower are of all-wooden construction. During last summer the airport was frequently used by charter aircraft operating from the United Kingdom.

COMET'S EXTENDED TRIALS

LAST week the Comet made a tour of the Continent, but did not land, as a preliminary to the extended trials, mainly associated with consumption, which are now due to start. Circuit procedure and ground-controlled approaches were also practised at London Airport on Saturday, taking off for the first circuit at about 9.30 p.m. It is said that the Comet fitted with ease into the normal airfield procedures and, except for the unmistakable noise of the four Ghost engines, was in no way out of the ordinary. Of particular interest was the G.C.A. control staff's reported impression that the approach was "notably slow."

AER LINGUS PROFITS

IN the first six months of the current financial year, Aer Lingus operations have shown a profit of £88,000 compared with a loss of £18,500 for the corresponding period of 1948. The profit is attributed to reductions in overheads and operating expenditure. Although the total of 135,000 passengers carried represented an increase of 12 per cent on the figure for the same period last year, the revenue earned was considerably less. This apparent anomaly was explained by the fact that fares had been reduced. Cargo carried amounted to 722 tons, which, although an increase of 50 per cent on the total for the half-year ended September 30th, 1948, still represented only three per cent of the total revenue. Mail, usually an important source of income to most airlines, was responsible for one per cent of total revenue.

The company states that the full year's operations are not expected to show a profit, due to the absence of a mail contract and the unlikelihood of any substantial increase in cargo traffic, together with losses which are normally to be expected from decreased passenger revenue during the winter period.

NAVIGATION INSTITUTE PROGRESS

PRINCE BERNHARD OF THE NETHERLANDS flew his Dakota from Amsterdam through poor weather to attend, as guest of honour, the Institute of Navigation's annual dinner in London on October 18th. During an entertaining after-dinner speech he remarked upon the significant mingling of R.A.F. and Naval officers, and then referred to the synonym in Roget's *Thesaurus* of navigation as "locomotion by water or air." The name of the Institute indicated, he said, its impartiality. Prince Bernhard suggested that in view of the variety and quality of modern scientific navigation aids, the specialized navigation qualifications required for air pilots were perhaps now unnecessary. He asked whether pilots, particularly those engaged in airline duties, could not make better use of their time than by studying to become specialist navigators. Sir Robert Watson-Watt, president of the Institute, said that in one-and-a-quarter years membership had doubled, a high quality in lecture subjects had been maintained, and the quarterly magazine had achieved for itself a unique reputation. The aim of the Institute, he said, was not merely to bring together professional navigators and those who provided the instrument aids, but also to bring into close contact with them those amateurs who navigated little boats and little aircraft for pleasure. Lord Pakenham, who replied for the guests, alleged that the United Kingdom was "thinking slightly ahead of others" in order to solve the problems of air traffic control. He paid tribute to Sir Frederick Bowhill who, he said, had helped civil aviation in post-war years more than had anyone else.

B.E.A.'s CHIEF EXECUTIVE

THE appointment of Mr. Peter G. Masefield, M.A., F.R.Ae.S., M.Inst.A.E., G.Inst.M.E., as chief executive of B.E.A. and as a member of the Board has been approved by the Ministry of Civil Aviation and was announced on October 18th by B.E.A.'s chairman, Lord Douglas of Kirtleside.

Mr. Masefield, who is 35, joined B.E.A. in January of this year as assistant to the chairman and later became deputy chief executive. Since the resignation of Mr. J. V. Wood he has performed the duties of the chief executive for the past three months.

Having learned to fly while at Cambridge University in 1932, he joined the design staff of the Fairey Aviation Co. in 1935 and two years later became a member of the editorial staff of *The Aeroplane*, subsequently becoming technical editor. During the war he was in France with the Advanced Air Striking Force, and in his later role as war correspondent with the R.A.F. and U.S.A.A.F. he flew on several raids in B-17s.

In after-war years his first senior post was that of personal adviser on civil aviation matters to Lord Beaverbrook, then Lord Privy Seal. In 1945 he became the first British Civil Air Attaché in Washington, and on his return was appointed Director of Long Term Planning and Projects at the Ministry of Civil Aviation, part of his duties being devoted to detailed planning work on such new aircraft types as the Brabazon and Comet. Among his many other activities Mr. Masefield is a member of the Council of the Royal Aeronautical Society, a member of the Civil Aircraft Research Committee of the Aeronautical Research Council, and president of the Ultra-Light Aircraft Association and of the Aircraft Recognition Society. He was recently appointed a director of International Aeradio, Ltd., on the resignation of Mr. J. V. Wood from the Board. He still finds time for active flying, however, and his

Mr. Peter G. Masefield.

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present duties often afford him the opportunity of piloting a B.E.A. Dove on business trips.

Mr. Masefield, who is one of the youngest executives of a major airline in the world, is a firm believer in the future of British civil aviation, and *Flight* wishes him continued success in his efforts to further the beliefs expressed in his R.Ae.S. lecture "Some Economic Factors in Civil Aviation" in 1948, in which he stated "The recipe for the future is a combination of enthusiasm, enterprise, experience, freedom for development, full consultation and, above all, the pioneering spirit blended with business acumen. And the whole thing must, for success, be founded on happy human relations and mutual confidence from top to bottom."

P.A.W.A. DEVELOPMENTS

A NEW daily service between New York and Bermuda will be started on November 1st by Pan American Airways. Its introduction will mean that this winter the company will be operating nine round-trip flights each week to and from the British possession. Seven will be flown by Stratocruisers and the remaining two by Constellations, calling at Boston.

A reduction of 20 hours in the present flight time between New York and Hong Kong is being made on a new scheduled through-service, which eliminates the change of aircraft and night stop at Calcutta. Flown by Constellations, the thrice-weekly through-service will obviate the necessity for use to be made of the DC-4 service which was previously operated between Calcutta and Hong Kong. The new flights make connections in Hong Kong with flights to Tokyo and Manilla, where prospective round-the-world travellers may connect with services to San Francisco, Los Angeles and Seattle.

A further fare reduction recently announced by P.A.W.A. is one of 25 per cent on the newly inaugurated twice-weekly DC-4 service which is being flown between Los Angeles and Honolulu *via* San Francisco. These flights are in addition to the normal Stratocruiser services which are flown daily on this route.

B.O.A.C.'S SYNTHETIC TRAINER

IN connection with the Stratocruiser training programme, B.O.A.C. has ordered a Curtiss-Wright flight simulator which, embodying an exact full-scale reproduction of the Stratocruiser's cockpit, not only simulates the instrument and control conditions actually experienced in flight, but also reacts as would a normal aircraft to all actions of pilots, whether intentional or inadvertent. Use of the simulator permits aircrews to be trained for their respective duties without the high cost and possible risk which would be involved in actual flight conditions.

The complete unit consists of a fully equipped cockpit in a

(*Continued on page 563*)

British Airways' Operating Statistics for June, 1949

(Figures for the corresponding period in 1948 are given in parentheses)

	B.E.A. All Divisions	B.E.A. Continental Divisions	B.E.A. British Division	B.O.A.C. All Divisions	B.O.A.C. Western Division	B.O.A.C. Eastern Division	B.S.A.A.
Passengers carried	78,238 (63,005)	31,203 (19,568)	47,035 (43,437)	11,806 (11,238)	3,815 (4,089)	7,991 (7,149)	1,315 (1,119)
Cargo carried :							
Mail (tons)	269.3 (153.5)	169.9 (54.1)	99.4 (99.4)	129.1 (136.5)	32.3 (25.2)	96.8 (111.3)	13.4 (15.0)
Freight (tons)	513.5 (333.6)	334.5 (236.2)	179.0 (97.4)	302.2 (284.4)	47.5 (40.2)	254.7 (244.2)	36.4 (41.9)
Overall revenue load-factor (per cent)	59.3 (59.9)	58.1 (64.6)	61.9 (52.7)	58.5 (61.5)	61.1 (60.1)	57.8 (62.0)	34.1 (51.8)
Average load :							
Passengers (No.)	14.8 (13.4)	14.7 (15.8)	14.9 (10.9)	18.1 (16.1)	32.3 (27.3)	15.6 (14.0)	6.5 (8.8)
Total (lb)	3,163 (2,843)	3,340 (3,570)	2,838 (2,056)	5,364 (4,690)	6,678 (7,013)	5,087 (4,283)	2,797 (3,402)
Average capacity :							
Seats (No.)	23.4 (20.9)	24.0 (23.7)	22.3 (18.1)	28.2 (23.5)	43.3 (42.3)	25.6 (19.9)	20.2 (17.5)
Total (lb)	5,336 (4,747)	5,744 (5,529)	4,585 (3,902)	9,174 (7,620)	10,934 (11,674)	8,803 (6,910)	8,194 (6,568)
Average length of haul (miles) :							
Passenger	275 (253)	427 (479)	172 (151)	2,897 (3,022)	2,353 (2,322)	3,155 (3,412)	1,527 (3,621)
Mail	452 (368)	620 (739)	165 (165)	4,844 (4,545)	3,761 (3,455)	5,206 (4,791)	5,482 (5,595)
Freight	477 (556)	631 (712)	189 (176)	3,748 (3,100)	2,959 (2,887)	3,895 (3,135)	4,806 (5,368)
Hours flown :							
Revenue : Passenger services	9,616 (8,472)	5,303 (3,532)	4,313 (4,940)	9,115 (10,969)	1,098 (1,374)	8,017 (9,595)	1,462 (2,163)
Cargo services	516 (319)	516 (319)	— —	1,080 (839)	452 —	628 (839)	278 (112)
Charter and special flights	148 (47)	3 —	145 (47)	172 (340)	— —	172 (340)	833 (9)
Non-revenue	251 (361)	99 (126)	104 (166)	1,139 (1,392)	150 (720)	989 (672)	294 (153)
Equivalent annual utilization (revenue hours flown) per aircraft	1,397 (1,434)	1,594 (1,545)	1,204 (1,359)	1,346 (1,344)	— —	— —	1,739 (1,481)
Unduplicated route miles in operation at end of period	14,391 (12,917)	11,556 (10,410)	2,835 (2,507)	64,336 (62,538)	7,700 (8,523)	56,636 (54,015)	19,895 (24,622)
Percentage regularity	98.0 (95.6)	97.4 (99.0)	98.4 (94.7)	99.7 (99.7)	99.7 (99.7)	99.7 (99.7)	97.1 (97.8)
Average length of stage flights (miles)	205 (177)	372 (390)	117 (115)	1,047 (944)	1,102 (1,099)	1,036 (922)	968 (1,128)

MINISTRY OF CIVIL AVIATION operating statistics for the British Airways Corporation during June, 1949, show that the increasing trend in load ton-miles flown during May was continued. The 7,400,000 ton-miles flown in June indicate an increase of 8.4 per cent over the figure for June, 1948. Passenger miles increased from 51,995,857 in June, 1948, to 55,455,987 in June this year, an increase of 6.7 per cent. The greatest rise in passenger miles flown was recorded by B.E.A.—33.4 per cent over the June, 1948, figure. Mail ton-miles increased from 760,689 to 820,550, a rise of 7.9 per cent over the corresponding period last year, a most outstanding gain being recorded by B.E.A., who increased mileage flown by 115.7 per cent. An increase of 20.2 per cent was shown in the freight ton-miles flown, from 1,292,081 to 1,552,449, in June this year.

Provisional figures for the scheduled services in association with B.E.A. show that 8,975 passengers and 397.4 tons of freight were carried during the month compared with 1,116 passengers and no freight in June, 1948. On the total internal scheduled services the load factor increased from 60.5 to 66.7 per cent. The car ferry service has been treated as a freighter service for the purpose of the statistics and the weight of each unit, comprising car, passengers and luggage, was counted as freight. The overall revenue load factor in the associated companies for June, 1949, was 52.3 per cent compared with 26.8 per cent last year.

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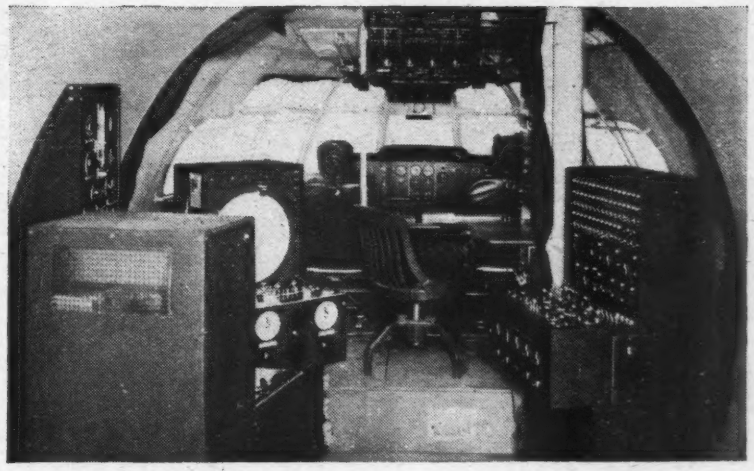
fuselage mock-up incorporating instrument and overhead control panels, all engine and auxiliary controls, flight engineer's panel, instructor's "trouble-making" console, radio-aids unit and flight recorder. Simulation of flight characteristics is initiated electronically by four computor units (one for flight characteristics and one for power services, the remaining two controlling two engines each), in accordance with operating data supplied by the aircraft manufacturers.

All emergency conditions can be reproduced, such as those arising from one or two engines "out," high-speed stalls, flapless landings, engine fires, overheating engines, faulty feathering mechanism, engine and instrument failure (complete or partial), and conditions caused by icing or turbulence. A sense of realism is added by the extensive use of sound effects such as engine starting, wheel braking, the whine of flap-actuating motors and the squeal of tyres touching the runway on landing, while the illusion of flight is heightened by the variable "feel" of the controls in different attitudes of the "aircraft." The "electronic brain," as the device is popularly described, contains some hundreds of radio valves, electric motors and even a built-in air conditioning plant.



CONVINCING MAKE-BELIEVE: This view from the entrance door of the flight-simulator Stratocruiser mock-up emphasizes the realistic appearance of the cockpit, and shows the instructor's position in the foreground, immediately aft of the night-flying curtain.

Radio equipment is fitted which can provide automatic simulation of I.L.S. landings, Radio Range with variable static, an automatic compass locator station which can be moved to any position for simulation of A.D.F. holding and approach procedures, V.H.F. two-course ranges, dual A.D.F., and approach-control technique. An automatic altitude-recorder is also incorporated. Provision has been made for the installation of omni-directional range equipment when it becomes available.

Pan-American Airways have been using a Curtiss-Wright flight simulator as an essential part of their training programme, and, it is stated, experience has shown that whereas 10½ hours of actual flight training are required for each pilot on the Stratocruiser, 15 hours of training on the flight simulator not only enables practice to be given in a far greater range of emergencies, but decreases actual flight training required to 3½ hours. B.O.A.C. has estimated that the use of this equipment, which costs £100,000, will represent a saving in training costs of £90,000 a year, a substantial proportion of which will be in dollars. B.O.A.C.'s flight simulator, which is being built under a licence arrangement between the Curtiss-Wright Corporation and the British firm of Redifon, Ltd., is not likely to be in service for about twelve months. Although it will not be available for the initial Stratocruiser conversion programme, the synthetic trainer will be used for routine 90 and 180 hour pilot checks and so will avoid the withdrawal of a Stratocruiser from operational service for the purpose.

BREVITIES

THE first of the three Short Sealands ordered for British West Indian Airways left Liverpool for Trinidad on October 19th. The aircraft, which is crated, is travelling by sea. The Sealands will fly between Trinidad and the Windward and Leeward Islands.

* * *

The purchase by the French Government of a complete radar system—said to include surveillance facilities together with G.C.A. equipment—for installation at Orly Airport, Paris, has been announced by the R.C.A. International Division.

* * *

Under an agreement approved by C.A.B., American Airlines and Delta Air lines are permitted to interchange equipment and crews. Passengers will thus be able to travel through both systems without necessarily changing aircraft.

* * *

It has been reported that Nation Wide Charter Service Co., of Taylor Field, Ocala-Florida, proposes to operate unscheduled charter services from the U.S. and Chile, specializing in the transport of horses. According to some sources, services have already commenced with DC-4s.

* * *

A 51-year-old pilot pleaded guilty before the Mildenhall Magistrates Court last week to a charge of flying a training aircraft without being in possession of a Pilot's Licence, thereby contravening Section 18 of the Air Navigation Act. He was fined £5 and ordered to pay £4 6s 11d costs.

* * *

A novel arrangement by which runway lighting can be switched on by the pilot of an airborne aircraft, even at an unattended airfield, is reported from America. Invented by Mr. J. F. Walker, the system is now in operation at Bellflower Airport, California. The device, which can be operated up to 25 miles from the runway, is actuated by pressing a transmitter microphone button in the aircraft seven times in quick succession. In response to this signal a radio control unit installed in the control tower on the airfield then switches on the runway lighting for any predetermined period of up to 30 minutes' duration, when relighting can be instantly carried out in the same way if required.

* * *

With the introduction of B.E.A.'s winter schedules the direct thrice-weekly London-Isle of Man service has been suspended, but the London-Belfast Sunday service has been diverted to call at the island on both outward and inward flights. A fare reduction of 25s for a monthly return ticket between London and the Isle of Man has also been announced.

* * *

Prospective candidates for aircraft radio licences should acquaint themselves with M.C.A. *Information Circular* No. 126 for 1949, which notifies change of address of the London Examination Centre. The new premises are at Ariel House, Theobald's Road, London, W.C.1, and no examinations will be held during the period October 24th to November 6th.

* * *

In reply to a question in the House of Commons by A. Cdre. Harvey on October 18th, Mr. Lindgren said that he was aware of the fact that pilots and navigators employed in the M.C.A. Communication Flight at Gatwick received salaries far below those paid by the Corporations or charter operators, and that the pension rates paid on their behalf were also below those advocated by the Minister himself for commercial firms; he stated that the matter was now under consideration.

* * *

Consequent upon C.A.B. approval last June for the operation, within specific limitations, of single-engined aircraft on scheduled services in the United States, two have started feeder services. Central Airlines are flying eight Beech Bonanzas over a 1,335-mile system in Oklahoma, north Texas and southern Kansas, and Mid-West Airlines are operating seven Cessna

CIVIL AVIATION NEWS . . .

190s over a network of 1,240 miles in Minnesota, Iowa, Nebraska and South Dakota. Fares are said to compare favourably with those for road and rail transport. It is also reported that the Post Office Department is considering the possibilities of mail services with single-engined aircraft.

* * *

The first flight of a weekly Hamburg-New York service began on October 10th, when an S.A.S. DC-6 took off from Fühlsbuttel with 42 passengers on board. This is the first direct route between Hamburg and the United States to have been opened since the war, and is flown *via* Scotland and Newfoundland.

* * *

With effect from November 1st, winter excursions between the United States and South America are being inaugurated by Pan American World Airways. The new rates, which will be 25 per cent lower than the original round-trip fares, are available for 21-day periods; itineraries include most of the popular resorts in the Caribbean, Mexico and Central America.

* * *

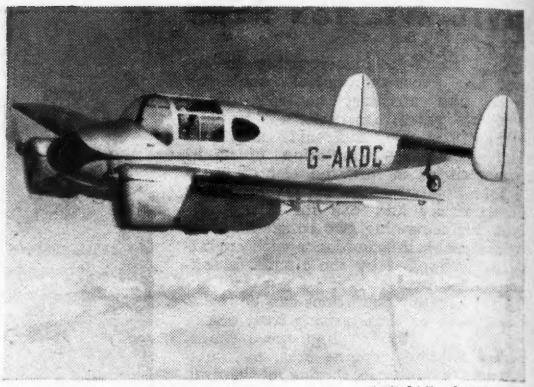
United Air Lines, the U.S. domestic operators, claim to have operated 99 per cent of their scheduled mileage for September, an increase of almost two per cent in a year. Other regularity records claimed are that 94 per cent of all departures were within 15 minutes of scheduled times, and that 80 per cent of all arrivals were within the same limits.

* * *

Philippine Air Lines have increased services on their London route to a once-a-week frequency, starting yesterday, October 26th. The company are flying Douglas DC-6s on a return service from Manila through Calcutta, Karachi, Lydda, Rome and Madrid to London, arriving on Sundays. After a turn-round check at Schiphol by K.L.M. return flights are scheduled to leave London on Wednesdays. Overall time in each direction is 41 hr. The service connects to Tokyo, San Francisco and other destinations on the P.A.L. network.

* * *

Mr. Gordon D. McGregor, O.B.E., D.F.C., president of Trans-Canada Air Lines, has been elected a member of the Executive Committee of I.A.T.A. He joined T.C.A. in 1945 and was appointed president in early 1948, succeeding Mr. H. J. Symington—who, incidentally, was I.A.T.A.'s first president. Since his association with T.C.A. Mr. McGregor has shown an active interest in the study of traffic problems confronting modern air transport, and in 1947 was made chairman of the Composite Sessions of the I.A.T.A. Traffic Conferences.



"Flight" photograph.

KING'S CUP VICTOR: Mr. Nat Somers flying over West London in his winning Gemini, which, since the race three months ago, has now been repainted in an attractive silver and black colour scheme. Mr. Somers is a member of the United Services Flying Club at Elstree.

* * *

As mentioned in *Flight*, of October 13th, Sabena sustained an operating loss of approximately £135,000 during 1948. It was, however, offset by the incorporation of a similar amount from a special provision made in 1946. During the year the company maintained a load factor of 62.5 per cent, carrying 146,111 passengers over 8,463,967 flying miles. In the previous year 186,127 passengers were carried over 7,747,359 flying miles. Freight and mail represented one-quarter of the company's traffic last year, compared with only 13 per cent for 1947. The total staff on October 1st, 1949, numbered 3,335.

FROM THE CLUBS

EIGHTEEN aircraft from flying clubs in the Midlands attacked the Yorkshire Aeroplane Club on September 11, but only four evaded the defenders and won their crews free lunches. The date of the Christmas party has now been fixed for December 28th, in the clubhouse, and a children's party is proposed for January 7th, 1950. Following the annual ball, to be held on November 25th at the Hotel Majestic, Harrogate, a free tea party will be given at the club for all those who attended the ball.

* * *

DISCONCERTING news comes from the Weston Aero Club at Weston-super-Mare. Western Airways are considering withdrawal of their support from the club at the end of this month, a step which would deprive it of all but one or two privately owned aircraft, and also of the clubhouse. At a meeting on October 14, Mr. F. G. Jeans, managing director of Western Airways, is reported to have said that the decision had been made necessary by an economic position for which "M.C.A. red tape" and the problem of complying with regulations concerned with Instructor Pilots had been mainly responsible.

The committee of the club is particularly concerned about the future of several pilots at present under training, and a general meeting was called for October 21st to discuss the entire matter in the hope of finding some solution. During the summer, flying hours averaged about 90 per month; membership has gradually increased, and the club had hoped to reduce the cost of flying in the near future.

* * *

BRITISH competitors were well placed in the International Rally contests organized by the Aero Club of Oran during the week-end October 15th-16th. In the final placings Mr. Jack Rice, in a Whitney Straight, won the second prize of fr. 200,000, Mr. Ercolani (Gemini) was fifth, and Mr. Peter Ayles (D.H. Rapide) was eighth. These three were, in fact, the only British entrants to arrive in Algeria on time. Out of the total entry of 38 aircraft only 23 completed the journey, mainly owing to fog and poor visibility over England and France. Two Piper Cubs from Holland were force-landed near Nancy, resulting in considerable damage to one, and Mr. Arthur Frogley (Leopard Moth) and Mr. Neville Browning (Messenger) both landed on the French coast, but were able to continue after a brief stop.

Marks were awarded for the distance flown, with a special bonus for the number of frontiers crossed *en route*. On arrival the visitors were entertained by Arab Chief Bachaga Makiki, of Peregaux, to a traditional "mechoui" feast in which several sheep were roasted whole on wooden spits and served personally by the Bachaga.

* * *

ON October 8th some 26 members of the Aero Club de Touraine visited the United Services Flying Club at Elstree. The party, which arrived in a Dakota belonging to Air Nolis, was met by the committee while club and private aircraft circled round to give a truly aerial welcome. Ranald Porteous flew down from Rearsby in an Autocar, the newest Auster product, which aroused much interest.

In the evening the visitors and some 60 members and friends attended a dinner and dance at the Aldenham Lodge Hotel, Radlett, during which M. Paratre, president of the Touraine Aero Club, expressed his pleasure at their reception. G/C. "Eustace" Miles, chairman of the A.B.A.C., proposed the toast of "Private Flying," and the party ended with an amusing auction sale which resulted in considerable benefit to the club's funds.

On October 9th the visitors were taken to the de Havilland factory at Hatfield, where they were shown Vampires, Doves and Comets under construction, and were later entertained to lunch. In the afternoon sightseeing flights around the neighbourhood were made in a fleet of about 16 aircraft ranging from Pipers to a Beechcraft Traveller. After tea the visitors took off for Tours in their Dakota.

As mentioned in *Flight* of August 11th, 14 aircraft had carried 43 members of the United Services Flying Club to attend the Tours Rally during the week-end of July 21st-24th, where they were awarded the Stella Cup for the largest representation. The visit of the French club provided the U.S.F.C. members with the opportunity of returning the hospitality they had enjoyed in July.

THOUGH the Continental visit which forms the subject of this article was a comparatively short one in point of distance flown, it contains several useful lessons for private pilots without previous experience of touring abroad. One is that even such a perfect summer as that just past can produce thick weather at inconvenient moments. The writer is a practised ex-A.T.A. and Service pilot; those of less experience would be wise to disregard the urge to "press on," especially when touring with a family on board.

The Argus and its passengers.

FAMILY FOURSOME

Recollections of a Summer Holiday Flight to France

By J. W. Haggas, A.F.R.Ae.S.

WHEN I was informed that my summer holiday this year would involve taking my wife and young daughters, aged seven and three, to South-west France by car, I did not look forward to the journey. "Why not do it by air?" I urged. "So much more convenient and restful for the children." Thus it came about that I found a Fairchild Argus four-seat cabin monoplane which I could hire for a week for £35, exclusive of fuel and oil, and flew her up to Panshanger one evening at the end of July. The following morning was fine and at 1030 hr we were loading our 150 lb of baggage. It would not all go into the boot, of course, but there was enough back seat left for my wife and younger daughter. They had flown only once before, but the comfortable car-like interior of the Argus assured confidence. At 1115 we were off and presently crossed the Thames near Gravesend, cruising at 105 m.p.h. indicated, the Warner Super Scarab engine running very smoothly. At 1210 we landed at Lympne and had a good lunch at the Lympne Country Club which adjoins the airfield. Here we refuelled to our full capacity of 50 gallons, which gave an absolute endurance of 5½ hours. Since we were clearing Customs for a foreign destination the fuel cost was 1s 8d per gallon and no landing fee was chargeable, which made a generous send-off from the old country.

At 1400 hr we took off into a S.W. breeze and climbed away towards Folkestone. Twenty-three miles away over the water the coast of France looked ridiculously close in the clear air, and, after a final check of instruments and magnetos, we headed out to sea, climbing slowly. Halfway across, our height was 4,500ft and we levelled off at that altitude, reaching Cap Gris Nez after a 16-minute crossing. By 1450 we were taxying up to the apron at Le Touquet and 20 minutes later we had cleared Customs and replaced the baggage in the aircraft. The Customs staff were literally waiting to serve us. We had tea and went for a stroll with the children before taking off at 1700 for Tours, 230 miles away to the south-west. The sky was clear as far as the eye could see, the air smooth, and the countryside full of colour in the evening light. We climbed slowly to 3,000ft and settled down to navigation. Major landmarks on the river Seine east of Rouen and at Evreux appeared on track and thereafter course was maintained, with small track adjustments at pinpoints, to Tours. At 1930 we touched down and were pleasantly surprised to be met at the end of the duty runway by a car containing my brother-in-law and family, who led us to our hangar. Tours is well inland, surrounded by wheat country, and enjoys hot, dry summers with skies of the purest blue, the air remaining very clear after long periods without rain. All the house-windows are shuttered and one is reminded of the Mediterranean scene. All this was very refreshing to come upon suddenly in the evening of a day that had begun in England.

We stayed near Tours for four days, doing some local sight-seeing flights along the river Loire and elsewhere. Then we moved on 125 miles to La Rochelle on the Biscay coast. All too soon my week was up, and I returned the Argus to its base at Blackbushe, leaving my family in France. The machine had given no trouble, apart from gradual failure of the starboard brake, which did not respond to local attempts at repair, and necessitated very slow, careful taxying and generous *pourboires* for assistance at the wing-tip. Fuel consumption was 9 gal/hr at 105 I.A.S., ground speed averaging 95 m.p.h. Fuel cost worked out at about 4s 3d a gallon flying internally in France and 2s 2d duty-free when leaving that country. Landing fees were 2s 8d at Le Touquet, 1s 4d at most other places, and (later) at Dieppe the charge was 1½d! No landing fee at all was charged on one or two occasions. Hangarage was charged for only once, at 1s 4d for one night. Maintenance charges totalled 5s for the week, and oil came out at 6 per cent of the fuel cost. Devaluation will presumably have raised the above figures by about 10 per cent. By suitable routing, incidentally, it is possible to operate principally on duty-free fuel.

The Argus is reasonably quiet. My family used cotton-wool earplugs and I used Mallock-Armstrong ear defenders, which are better, as they leave no singing in the ears after a day's flying.

Back to the Continent

At 1530 on August 26th I took off from Blackbushe, together with a friend who was to accompany me to Nantes. There had been fog earlier and visibility was 3,000yd. In the Channel the sea was almost flat calm, and from 3,000ft appeared to merge almost immediately into the haze. In due course Cap Gris Nez appeared and visibility improved to 2-3 miles inland from the coast. At 1730 we left Le Touquet for Nantes; the view was very poor into sun, but better on the driving side. There was doubt whether we could reach Nantes in light and Laval (Entremmes) was our alternate. After Lisieux good landmarks became fewer and about this time it began to rain and became rather dark and depressing. I was considering calling it a day when I glimpsed blue sky beyond the showers and presently it lightened and we could see several miles. At 2005 we were over Laval and, though it was still light at 2,000ft, we were too late to make Nantes, 75 miles away.

Laval is a sizeable grass airfield, with smoother pitches

FAMILY FOURSOME . . .

forming the landing strips; there were a few gliders about, and we noted a great economy of buildings. A narrow metalled road crossed the duty landing-strip at right angles at a quarter of the distance from the downwind end, so we cleared it before touching down. Prior to this we had been making wheel landings to preserve pressure in the tailwheel cylinder, but this time we three-pointed, expecting a rough surface, and we were not disappointed. At the little clubhouse building, where many of the local children as well as club members awaited us with interest, we parked the Argus beside the resident Stampe biplane, which appeared to live a hardy existence in the open. In the bar we were hospitably received and a fair amount of the local cider was required to moisten my uneaten sandwiches. When the bar eventually closed the question of a bed became more immediate. It happened that there was a large haystack to hand, only a few yards from where the Argus stood; we climbed it—with great difficulty—and found a flatter place at one end where the ridge was not complete. The night was fine and I slept remarkably well.

At 0830 the following morning the shepherd was rounding up the last few sheep from the airfield as we started and ran-up the engine. At 0855 the chief flying instructor arrived and asked us where we were going. The answer, "to Nantes," appeared satisfactory, and by 0900 we were commencing take-off—our earliest start. It was prolonged by patches of shale, which greatly retarded the aircraft each time we struck one. It was reassuring to have an aircraft with a substantial load on the tailwheel for this sort of thing. Visibility lowered as we approached Nantes and ran-in by following the 15-mile inlet of the river Erdre. After a few minutes of search the light-coloured runways of Chateau Bougon airfield appeared through the haze, and at 0955 we touched down.

Through the Murk

Large airfields often mean lengthy stays for small aircraft, and here the met. service said an "actual" for Poitiers, 100 miles away, might take 45 minutes to obtain, without which their "forecast" could not be issued nor the flight-plan completed. It was 1120 before I was airborne and soon cloud-base was giving me concern, but conditions remained just acceptable until I reached Poitiers (Biard), which has quite a good grass surface and modern hangar building. Here my family awaited me and the following morning we all prepared to leave for home. Local weather was overcast, with visibility four miles. The route forecast indicated 1-3 km visibility in many places, with better conditions at Le Touquet; all this was not ideal, but justified a start. We left Poitiers at 1225 and within ten minutes visibility was down to one mile, cloud-base 1,100ft—rather gloomy, but workable over the low ground leading to the Loire, which we crossed near Langeais. The cloud-base so far experienced suggested that the higher ground on our track north of Tours would be in cloud, and to circumvent this area we followed the Loire eastward to Blois and then headed north to Chateaudun, the sun making a fitful appearance. Near Chateaudun precise contact was lost and course maintained, approximate position being deduced by watch from the last known pinpoint at the Forest of Marchenoir.

Twenty minutes later exact position was confirmed west of Dreux, while the sky became dark again and the view very restricted, and at 1505 we crossed the Seine at Pont de l'Arche in dense haze. This deterioration I thought local, due to smoke from Rouen nearby, and continued in expectation of improvement, altering course to avoid higher ground in the St. Saens region and aiming to reach the coast at Dieppe, now only 43 miles away. Once there, following the coast to Le Touquet should be possible even in very thick weather. At 1510 visibility improved slightly, but cloud-base was lowering and becoming ragged, and at 1515 I began to suspect we were running into sea mist, probably down to the ground at the coast. We were down to 400ft above the ground, and although it was necessary

"We stayed near Tours . . . doing some local sight-seeing flights along the River Loire . . ."

to abandon hope of getting to Dieppe, I did not wish to fly back through the dirty weather near Rouen if it could be avoided. At 1518 I found what I wanted—a large cut cornfield, clear of stooks, with three big ricks to help identification while circling. It had telephone wires along its north border and a fair run parallel to them, with an extension into a wood. The first low approach along this direction revealed prohibitive downhill slope in the extension part. The next approach, from the south, was of adequate length, partially obstructed by trees on the approach, and very noticeably uphill. Wind was negligible. A second low run, this time diagonally from the S.S.E., gave a better approach, and the surface appeared free from big ruts. Finally we came in with full flap at 75 m.p.h.; there was a pronounced check as the hill appeared to rush at us, a very short hold-off and we were down and pulling up very rapidly. We stopped with about 150 yd to spare. The time was 1527, and fuel for 2½ hours remained.

From the nearby village of Montreuil-en-Caux I 'phoned Le Touquet and then engaged a local gamekeeper to guard the aircraft. We were accommodated at an inn in the village and learnt that Dieppe had been fogbound intermittently for a few days. By 0900 the following morning, however, it was reported clear of fog, which was extremely fortunate for us. As a precaution, I put my family and all the luggage on to the local train to Dieppe, 17 miles away, and this also lightened the machine. The Argus requires up to 600 yd to take-off when fully laden, and I had decided she would have to be flown out downhill, as uphill acceleration is poor. I paced out 700 yd diagonally down the field, of which not more than 500 yd were usable, due to the ground rising again in the next field, and trees farther back to be cleared. There was one shallow rut extending a quarter of the way across the field—better to avoid—and there was no wind.

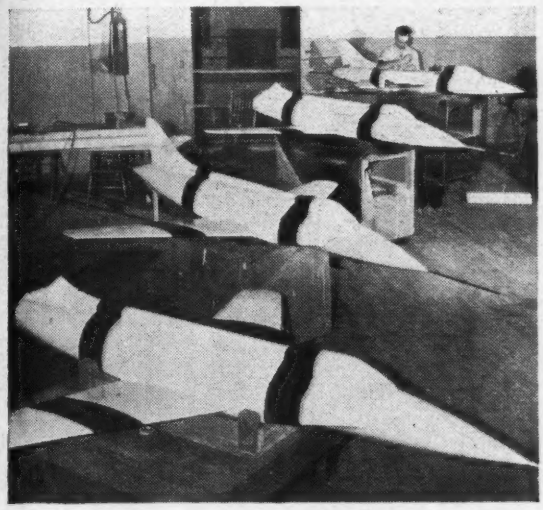
There were about forty spectators, including the Mayor and *Chef de Gendarmerie*, and, as I got my usual easy start on the batteries, I was able to entertain them with the minimum of delay. I taxied briskly along the northern boundary to the N.W. corner, swung quickly into the take-off direction, S.S.E., at about 25 m.p.h., and gave full throttle. We roared away down the hill, accelerating rapidly, were airborne at half-distance, and cleared the trees comfortably. Ten minutes later I landed at the neat little airfield of Dieppe to await my family. An hour afterwards we were following the beaches and sand bars along the gently curving coastline to Le Touquet. Once again the Channel was almost flat calm and weather hazy. For fifteen longish minutes nothing relieved the eye but our shadow on the water below. Over England again cloud increased and we picked our way along carefully at 900ft to conform to I.F.R. in force, and at 1605 landed at Blackbushe, where we took leave of the Argus which had served us so well.

DROP-MODEL TESTING

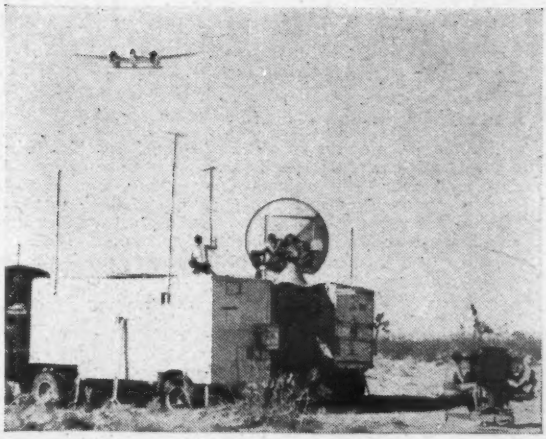
New U.S. Pre-Flight-Development Technique

IN outlining the development of one of its latest military products—the XF-90 penetration fighter—the Lockheed Aircraft Corporation has stated that about half the data normally obtained only by test-dives of a complete aircraft was actually collected before the first flight by the use of radio-equipped scale-models dropped from high altitude.

The models, fabricated from steel and plastic material, and made as heavy as possible, each contained a minute radio transmitter to broadcast load and control-force readings during the dive from 35,000ft. A Lockheed P-38 was employed to take the XF-90 models to altitude and release them on instruction from ground tracking stations. The resulting dive, during which control-surfaces were automatically operated, was supersonic and, naturally, always resulted in complete destruction of the model.



Shortly before the first flight, a miniature production-line was established for construction of the XF-90 models.



Radar tracking stations recorded the behaviour of each model during descent from the Lightning "mother-ship".

An industry design-competition initiated Lockheed work on the XF-90 in August, 1945, and the design was accepted by the U.S.A.F. Air Materiel Command in 1947 for further development and construction of a prototype. Lockheed's design office is stated to have studied 65 different configurations before deciding on the final swept-surface, "needle-nosed" outline. In addition to the model-dropping programme, pre-flight aerodynamic research included testing in the Lockheed research laboratory and wind tunnel, the U.S.A.F. spin tunnel at Wright Field and the Caltech Co-operative wind tunnel at Pasadena, California.

SHORT BROTHERS' LOSS

AS reported in *Flight* last week, four lives were lost when the Short Sealand which was making a demonstration tour of Scandinavia struck a mountainside near Soangereid, Norway.

One of the passengers was Mr. George Puddicombe, of the sales department of Short Brothers and Harland, Ltd. Thirty-five years of age, Mr. Puddicombe had joined Short Bros.' drawing office in 1939, subsequently acting as liaison officer between the company's factories and R.A.F. units. Then, as senior foreman in the development department, he was closely concerned with the construction of the first Seaford and with the whole of the equipment for the Shetland. In 1945-46 he represented his firm at the Marine Aircraft Experimental Establishment, Felixstowe, and in the two following years he was their technical representative in New Zealand, returning to occupy the post he held at the time of his death.

The second member of Short Bros.' staff was Mr. Hugh Adams, 38, flight engineer, who had joined the firm in 1937, subsequently serving in the R.A.F., where, as a flight sergeant, he was mentioned in dispatches and, in 1943, was awarded the B.E.M. (Military Division). Rejoining Shorts in 1945, he was appointed, in the following year, as technical representative on the Junkers conversion contract, and was subsequently engaged on inspection duties.

As the firm's own pilots were fully occupied they had applied for the services of a R.A.F. officer with marine-aircraft experience to take the Sealand to Scandinavia, and F/L. D. G. McCall was selected. McCall, who was 26 years of age, had joined the Service in 1941, receiving his commission in June, 1943, and had subsequently been employed on instructional duties. He was posted to Felixstowe in 1945, and, except for a course at the Empire Test Pilots' School, was there up to the time of the ill-fated tour.

Also on board was Mr. O. R. B. Olsen, the Norwegian representative of Short Brothers and Harland.

The Sealand's crash deprives the firm—which, incidentally, has a remarkable record of freedom from test-and-demonstration accidents—of the first production model of this twin-engined 5-8-passenger amphibian. The prototype, however, remains at Belfast, while of three production machines ordered by British West Indian Airways one is already in course of delivery.

A. E. HAGG RETIRES

AFTER more than 30 years in the aircraft industry, Mr. Arthur Ernest Hagg has announced his intention of retiring, and has accordingly relinquished his position as technical director of Airspeed, Ltd. He commenced his aircraft-designing career as assistant to Capt. (now Sir Geoffrey) de Havilland at the Aircraft Manufacturing Co., Hendon, in 1915, and remained with him when the de Havilland Company was founded after World War I, ultimately being appointed to the Board in 1935. Mr. Hagg was partly or wholly responsible for the design of most of the "classic" D.H. types. Leaving the firm shortly before World War II, he held posts in other spheres of engineering, returning to aviation in 1943 as chief designer and technical director of Airspeed, in which capacity he was responsible for the design and development of the Ambassador.

Mr. A. E. Hagg.

Some months ago he handed over his design responsibilities to Mr. G. H. Miles, who was then appointed to the position of chief designer of Airspeed, Ltd. Mr. Miles, of course, is well known as the designer of most of the notable types formerly made by Miles Aircraft, Ltd.

THE RELIABLE HERCULES

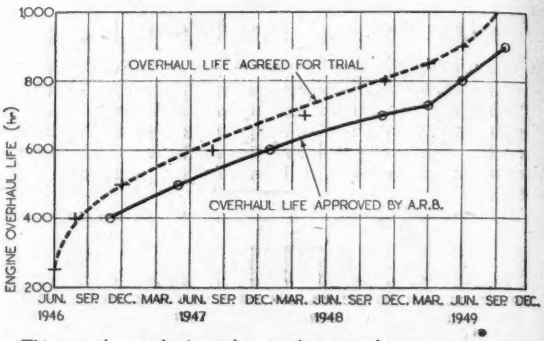
Overhaul Period of 630 Series Engine Further Extended

SINCE the days of its first extensive application in military aircraft, such as the outstanding Beaufighter, the Bristol Hercules has proved itself to be one of the most reliable and popular units in the piston-engine category, and the news of A.R.B. approval for still further extension of the overhaul life of the 630 series to 900 hours represents yet another step in the long career of a highly successful power unit. The Hercules 630 series, based on the original Hercules 100 engine, is a version designed exclusively for civil use. Some 57,000 of the 100 series units were manufactured for use in military aircraft during the war.

Under the stimulus of wartime development and with background provided by such an enormous total of engine running hours, the power output and overhaul periods of the military Hercules had shown very rapid increases, and the 100 series was already producing 1,800 h.p., compared with the 1,325 h.p. of the original mark, when the time came for thoughts to be turned to development of a version for civil use. The first, the 630 series, designed for operation at medium altitudes and consequently fitted with only a single-speed supercharger, was type-tested in May, 1945, and produced 1,690 h.p. fitted with flight-type exhaust system (after boost pressure had been raised 1 lb/sq in to compensate for exhaust installation losses).

The next civil design to appear—in keeping with modern trends towards increased take-off power—was the Hercules 730 series, incorporating such improvements as the copper-based cylinder head to provide the increased cooling necessitated by higher power output. Although take-off power of the "730" was originally 1,860 h.p., the output was steadily increased by modifications and improvements until the present-day figure of 2,040 h.p. with exhaust system was attained. This is no mean achievement for an engine with a swept volume of 38.7 litres.

In order to provide adequate power for the high-altitude operation of pressurized airliners, the development of the 760 series, fitted with two-speed superchargers and an additional 150 h.p. drive for cabin blowers and large generators, was the next step. The latest variation, the 763 series, now installed in the Hermes IV, gives 2,100 h.p. for take-off. Increases in power output were not the full extent of Hercules development: in fact, they were eclipsed by the rate at which the overhaul life of the "630" was improved in the short span of three years from 250 hours for the initial installation in the Viking aircraft to the 900-hour life approved on October 14th, 1949.



This graph emphasizes the steady rate of increase in overhaul life of the Bristol Hercules 630 series engines.

First of the engines to reach 900 hours was a Hercules 634 installed in a Viking operated by Airwork, Ltd., which since manufacture had completed a total of 2,025 hours' running. The rapid manner in which overhaul life has been extended is emphasized by the fact that previous overhauls of this engine had been carried out at 500 and 1,222 hours respectively, the third period of its life being 50 per cent longer than the second.

The accompanying graph shows the rate of increase in the overhaul life of the 630 series. An indication of the high proportion of hours actually achieved is the fact that out of a total of 124,150 permissible hours, four leading airlines have achieved an average of 92.2 per cent of those hours in actual running time. This is particularly notable when it is considered that this average includes all engine changes, some of which were made somewhat ahead of time as a matter of convenience to the individual operators.

A trial batch of engines is now being run to 1,000 hours, and the makers have little doubt that approval will soon be obtained for this period.

LOOKING BACK

Dr. A. P. Thurston Recalls Memories of Maxim

SOME interesting reminiscences of the early days of aviation were given by Dr. A. P. Thurston, M.B.E., D.Sc., M.I.Mech.E., F.R.Ae.S., in his presidential address to the Newcomen Society, delivered at the Science Museum, South Kensington, on October 12th.

In 1903 Dr. Thurston became chief assistant and designer to Sir Hiram Maxim, who at about that time had conceived the idea of making the public "air-minded" (and, incidentally, of making them pay for the privilege) by means of rides in his "captive flying machines," one of which was erected in the grounds of the Crystal Palace, to be a popular attraction for many years. As older readers of *Flight* will recall, this large and impressive structure consisted of a series of long radial arms resembling umbrella ribs, braced to a central steam-driven shaft; from the extremities of the arms were hung cars equipped with wings and other aircraft features.

Dr. Thurston, who designed several of these devices for Maxim, recalled that when the first was erected and had been tested with sandbag ballast the engineer-in-charge invited the young designer to make a "test flight." "Speed was increased," recalled Dr. Thurston, "until centrifugal force was 6.87 g. After a mighty mental struggle I fell unconscious to the bottom of the car. Fortunately I had with me in the machine a workman who was in a more advantageous position, and he was able to give the signal to stop. I recovered consciousness at about 3 g. and was able to walk when we stopped. Sir Hiram put me in the car again after lunch and ran me up to 3 g.; I took this all right."

Maxim and his assistant actually used the Crystal Palace machine for aeronautical research. In 1904 Dr. Thurston was able to drive a model through the air at 100 m.p.h. and measure the lift of the wing, which worked out at 7lb/sq ft—a figure which appeared to disprove current mathematical theories of maximum lift obtainable.

During the period 1905-09 Maxim was busy designing his second aircraft and its power unit. The lecturer recalled that the wings were of thin section, strengthened by longitudinal spars and ribs, and were double-surfaced. Provision was also made for the eventual incorporation of automatic control by gyroscope. A new type of petrol engine was designed with a novel carburettor, unconventional lubricating system and skew-gear-operated overhead valves, vanadium steel cylinders and spun German silver water jackets; that unit was now in the Science Museum.

First trials were made with the machine held captive to a mast with a swivel-head attachment for the cable. The engine drove a small central airscrew and two large outboard airscrews by means of cable belts. This drive gave much trouble. During the final trials one of the aluminium driving wheels on one of the large airscrews broke and the cable wound up on the engine and collapsed the machine.

It was while these experiments were being made that the great aviation meeting was held at Rheims, when Latham's Antoinette monoplane climbed to the then amazing height of 500 ft.

During World War I Dr. Thurston served in the R.F.C. and became a technical inspector, in which position he was able to replace by more scientific procedures many of the rule-of-thumb methods then used for investigating structural failures.

Recalling the highly successful S.E.5, conceived by the then

chief test pilot of the Royal Aircraft Factory, Capt. Frank Goodden, Dr. Thurston said that, initially, two machines were built and flown. The first collapsed in the air after 20 or 30 hours' flying and Goodden was killed. The committee of enquiry found that the accident was caused by the airscrew breaking and fracturing the wing structure. "I didn't believe this," said Dr. Thurston, "and therefore ordered that a guard be placed upon the wreck and the hole searched and the pieces of the airscrew found and placed together. The whole of the periphery of the airscrew was found, assembled and photographed. It was obvious that the fracture was *not* due to the airscrew. I found, however, that one bottom front spar had failed by downward torsion. This could not have happened unless something else had failed previously in the interior of the wing. I therefore visited the second machine, which had been flown for nine hours, and gave the bottom wing a bang with my hand. There was a nasty jarring sound from the interior bracing, which was evidently slack. I therefore stripped the fabric with my penknife and incipient lines of failure could be seen in the varnish of the strengthening ribs between the struts. The structure, in effect, was like a box without a bottom. There was no provision to resist torsion due to download on the front of the wing, so I suggested that a piece of three-ply should be placed between the upper and bottom ribs and the front and back spars to take the torsion. This was done and large numbers of this very fine machine were made and flown without further trouble.

"By taking advantage of every piece of evidence available a system of design and testing was evolved which, with slight modifications, has remained in force to the present day."

A.T.C. GLIDING NEWS

New Two-seat Trainer : Some Soaring for Cadets

RESERVE Command announced last week that it is hoped to provide each of the 49 A.T.C. gliding schools with one Slingsby Sedbergh two-seat trainer by March next year, and that, during 1950, the schools will work to a new, more ambitious programme.

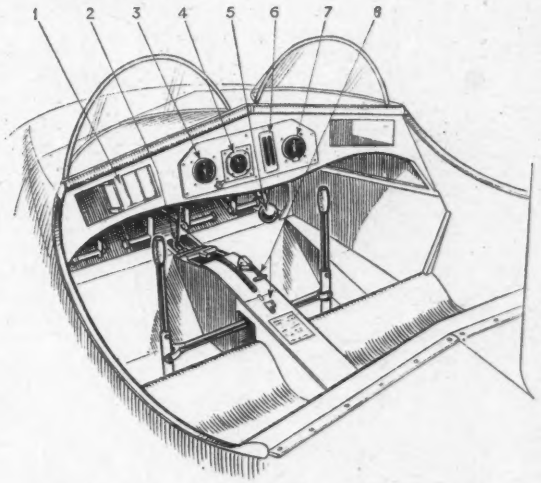
The Sedbergh X Mk. 1, to use its full designation, is identical with the successful civil two-seat training glider known as the Type 21B, which was designed to provide clubs with a robustly constructed and easily maintained aircraft of medium performance. Forward of the two main wing-attachment frames, the fuselage is of wooden stressed-skin construction, the remainder being of fabric-covered girder type. The braced, 54ft-span wing, mounted on a large faired bulkhead, is of wooden construction, fabric-covered aft of the main spar, and the control surfaces also are fabric-covered.

The cockpit, forward of the main bulkhead, has side-by-side seating with dual stick-and-rudder-pedal controls, and offers excellent visibility. Provision is made for the wearing of back-type parachutes, and there are twin "bugs-eye" windscreens to protect the occupants during air-towing. A larger type of full-width windscreen has been found to set up severe turbulence. For comfort when acting as passenger, each occupant can rest his feet in a well in the cockpit floor.

The Sedbergh has an all-up weight of 590 lb. Its best gliding angle is 1 in 21 at 42 m.p.h., and its minimum sinking speed is 2.8 ft/sec at 38 m.p.h. Over a speed-range of 36-50 m.p.h., the sink remains below 3.75 ft/sec, and the gliding angle does not exceed 1 in 18. Stalling speed is 28 m.p.h.

Very few of the A.T.C. schools had the advantage of using a two-seat trainer, and the majority of pupils have been taught the rudiments of gliding—and little more—in single-seat Cadets and Prefects, together with a few non-standard types such as the German Grunau Baby. The advent of the Sedbergh will permit a much higher standard of training to be reached, and will enable the instructors to log more flying hours than were previously possible.

The Royal Aero Club's "A" certificate—which entails a straight solo flight of 30 sec—has been the standard reached by the majority of A.T.C. gliding pupils, but during next year those who show sufficient promise will graduate to the solo circuit stage, in which a one-minute-flight qualifies for the "B" certificate. Reserve Command also announces that, in exceptional circumstances and suitable weather, a certain number of cadets will be allowed to qualify for the "C" certificate by making a five-minute soaring flight.



Items of interest in the Sedbergh cockpit are: (1) batteries; (2) quick-release; (3) A.S.I.; (4) turn-and-slip indicator; (5) quick-release knob; (6) variometer; (7) altimeter; (8) spoiler control lever and lock.

New servicing arrangements will be in operation next year, whereby instructors will undertake only minor maintenance duties, while second- and third-line servicing of the gliders will be in the hands of the nearest R.A.F. station, or—where distance is prohibitive—an R.A.F. mobile servicing party. There will be improvements in the type of ground equipment issued: new 15-cwt trucks are now being modified for use as retrieving vehicles, and more efficient winches will be in service, giving better launches and greater serviceability.

During July, Reserve Command opened its Instructors' Gliding School at Detling, where some of the A.T.C.'s 500 instructors are now on preliminary courses. The school is now commanded by F/L. R. C. Forbes, a well-known sailplane pilot.

In 1928, 2,127 cadets reached "A" certificate standard, and by June of this year 1,186 were similarly qualified; an indication of the Corps' enthusiasm is the fact that the demand for glider training has generally exceeded the capacity of the schools. Although the introduction of the Sedbergh and other new equipment may not increase the numbers of cadets trained, the instruction will be more advanced and more useful. Apart from its value as pre-Service training, the new A.T.C. programme may, by giving its members deeper insight into the art of soaring, strength of the British gliding movement.

(Left) The civil version of the Sedbergh, the Type 21B, has given good service to clubs for many months.

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

AIRMET

I AM glad to see that your correspondent Mr. Church (October 13th) gives credit to the excellent services of Airmet—a credit which receives your Editorial endorsement.

Whilst sharing in the view that footling tootling as an interval signal deserves a long rest, I cannot agree that "Auld Lang Syne" would prove a very happy alternative. Let us have a boost for Scotland whenever possible, but not in any circumstances when that boost might suggest that our weather information is going to consist of ancient memories.

Now that Airmet has attained such a status of excellence and efficiency, would it not be possible for forecasters to spare a little time for vocal training? They would then be able to introduce their up-to-the-minute bulletins operatically; and what better song than "It will all come to pass as I tell thee"? JOHN GRIERSON.

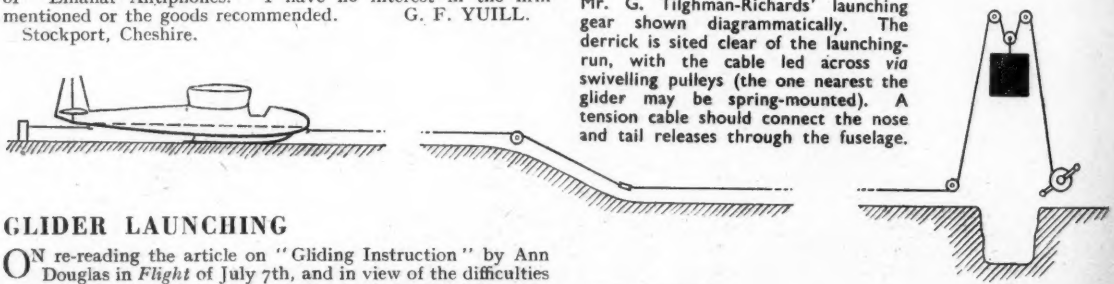
London, W.1.

SEARCH FOR SILENCE

THERE is one solution of the very real problem of sleeping in the present age of noise which I have not seen mentioned in your columns and one of which I have had years of experience and satisfaction—that is, to *exclude the offending noises* by the very simple use of soft wax plugs in the ears. I have used it since 1943 to deal with such varied disturbances as bombers taking-off, Service uproar while sleeping after night duties, main-road night traffic, neighbour's radios and night-train clashings.

Any soft wax will do but much experimenting is saved by buying the plugs ready made—each wrapped in a wad of cotton wool—as sold by many drug stores and certainly by Roberts and Co., 76, New Bond Street, London, under the trade name of "Elnahar Antiphones." I have no interest in the firm mentioned or the goods recommended. G. F. YUILL.

Stockport, Cheshire.



Mr. G. Tilghman-Richards' launching gear shown diagrammatically. The derrick is sited clear of the launching-run, with the cable led across *via* swivelling pulleys (the one nearest the glider may be spring-mounted). A tension cable should connect the nose and tail releases through the fuselage.

GLIDER LAUNCHING

ON re-reading the article on "Gliding Instruction" by Ann Douglas in *Flight* of July 7th, and in view of the difficulties of which she writes, I am wondering if there might be some help for beginners to be derived from our practice in launching when we were gliding at Kirkby Lonsdale away back in 1912. We had no instructors in those days and were free to dismember ourselves and the machines at our own discretion; our only helpers were the farm people and the local builder and his men, and we could never rely on their being available when the conditions were right. In consequence, we had to evolve some system whereby the work could be carried on by our two selves alone, sometimes one alone, and the results were eminently satisfactory.

We therefore erected a derrick on the hill-top, with a weight, a winch and a track (which was not really essential and in our case was mistakenly fixed in position, pointing due east, and with a "falling front" to prevent the glider receiving a downward tug at the moment of leaving the track).

The sketch shows the general arrangement of such a launching rig. The sequence of operations is as follows:—

First, the machine is laid about two or three feet from the track end, or from the cable pulley and, with the weight resting at the ground level (or at the bottom of a deep hole in our case), the release is coupled up and a mark—a double hitch of white tape—bound on the towing cable at a point adjacent to the derrick.

Secondly, the machine is uncoupled and moved back to its ready position, and the tail release coupled up. Thirdly, the operator, having freed the winch barrel, hauls the cable through the system until the forward (open-hook-type) release can be coupled. This, of course, represents the travel of the glider whilst launching, and at this point a second mark should be bound on the cable at the point where the original mark was.

This travel between the first and second marks should be measured and divided by the value of the weight tackle used, i.e., by 2 for double purchase, or 3 for treble purchase, and the weight lifted by the winch to this height above the position of rest. We ourselves used an 80ft run with 40ft travel of the weight, with double purchase, but that required a 20ft hole for the weight. The measurement should be repeated after every few launches as the weight naturally tends to thump itself deeper into the ground.

Since during winding and waiting on the track, there is full tension between the nose and tail releases, it is necessary that a tension cable should join these points to relieve the fuselage of undue tension.

The hardest work is in getting the glider back to the launching point, and this can be overcome by a second winch and a piano wire run out to the machine. Of course, a wheeled trolley is a great help, but again is not essential.

Provision should be made for the tail-release fixing to be moved round a radius, with several prepared points, to suit the prevailing winds.

The whole thing could be fixed up from the local builders' yard, and the necessary sheaves and tackle picked up in junk yards. The weight could be some old steel tank filled with stones or scrap, or a stout barrel well strapped with hoop iron. It should obviously be robust to stand constant shocks. In our case, with the glider and pilot weighing about 700 lb, we found that between 11 and 13 cwt was sufficient.

The Science Museum, G. TILGHMAN-RICHARDS.
South Kensington.

[An ample margin of strength would have to be allowed throughout the structure and cables, otherwise the heavy loads involved would constitute a serious risk to the operators.—ED.]

NO CZECH

IN your issue of October 15th, page 496, you illustrate a Swiss-registered Avia F.L.5. This is not, as you say, a Czech design, but the Italian Lombardi F.L.5 (the initials A.V.I.A. stand for the predecessors of the present firm, Azionaria Vercellese Industrie Aeronautiche). D. A. S. McKAY.

Peckleton, Leicester. F/Lt.

FORTHCOMING EVENTS

Oct. 27. Royal Aero Club, Londonderry House: Film show. "British and American Helicopters," C. Colin Cooper.
Oct. 27. R.Ae.S. Graduates: "High-lift Devices," R. R. Duddy, A.F.R.Ae.S.
Oct. 31. R.Ae.S. (Derby): "Cierva Air Horse," J. S. Shapiro, Dpl. Ing., A.F.R.Ae.S.
Nov. 2. R.Ae.S. (Luton): "Gas Turbine Development."
Nov. 3. R.Ae.S. Graduates: "Hydraulic Analogy of Compressible Flow," H. Ritter, B.Sc. (Eng.).
Nov. 7. R.Ae.S. (Derby): "Structural and Mechanical Testing of Aircraft," by J. C. King, M.Sc., A.F.R.Ae.S.
Nov. 8. R.Ae.S. Section Lecture: "Resonance in Aerodynamics," R. A. Shaw, M.A., F.R.Ae.S.
Nov. 9. R.Ae.S. (Weybridge): "The Brabazon I," F. H. Pollicut, F.R.Ae.S.
Nov. 15. R.Ae.S. Graduates: "Visualization of Airflow at High Speeds," A. D. Young, A.F.R.Ae.S.
Nov. 16. R.Ae.S. (Brough): "Stiffness and Strength," Prof. A. R. Collar, M.A., D.Sc., F.R.Ae.S.
Nov. 18. Institute of Navigation: "Navigation in High-Speed Flight," Wing Cdr. E. Anderson.
Nov. 19. British Interplanetary Society: Symposium, "Medical Problems of Space Travel."
Nov. 20. Society of Model Aeronautical Engineers: Annual General Meeting.
Nov. 22. R.Ae.S. Section Lecture: "Engine-driven Gearboxes," G. W. Bubb, A.F.R.Ae.S.

SERVICE AVIATION

Royal Air Force and Naval Aviation News and Announcements

PERFORMANCE IN OUTLINE: Of unmistakable plan form, the Hawker P.1052 experimental fighter (R.-R. Nene) has frequently demonstrated during the year that its exceptionally high speed is reconciled with remarkable handling qualities.

Bombing Competition Revived

THE Laurence Minot Bombing Trophy, which was presented to the Air Council in 1926 by an anonymous donor in memory of the late Capt. Laurence Minot, M.C., who was killed in air combat on July 28th, 1917, while serving with No. 57 Squadron of the R.F.C., is again being offered for competition among R.A.F. bomber squadrons. The trophy was originally awarded for the best individual crew performance of pilot and bomb-aimer during a set competition between the regular bomber squadrons of the Air Defence of Great Britain which came in the Wessex Bombing Area—the precursor of Bomber Command to-day. From 1930 until 1936, the trophy was confined to competition between night bombing squadrons in home commands, and was awarded annually under conditions laid down by the A.O.C.-in-C. of Air Defence of Great Britain. It is now being awarded to the Bomber Command squadron showing the best all-round excellence in training throughout the year.

Amongst the names on the trophy, which is at present held at Waddington by No. 50 Squadron, is that of W/C. C. F. A. Portal, D.S.O., M.C. (now Marshal of the R.A.F. Lord Portal), who was A.O.C.-in-C. Bomber Command in 1940 and Chief of the Air Staff from 1940 to 1946. He was bomb aimer when the trophy was won in 1927 and 1928 by No. 7 Squadron, which held it for seven years in all up to 1936, and once shared it with No. 58 Squadron, its chief rival. Commanding officer of 58 Squadron in 1927 was W/C. A. T. Harris (now Marshal of the R.A.F. Sir Arthur Harris), who succeeded Lord Portal as A.O.C.-in-C., Bomber Command. The two men who became chiefs of Bomber Command during the second world war served side by side at that time, both squadrons being stationed together at Worthy Down. Lord Portal's pilot in 1928 was A. Cdre. (then F/O.) G. D. Harvey, C.B.E., D.F.C., now Director of Postings (A) at the Air Ministry. The contest took place that year at North Coates Fitties, and the bombing accuracy they achieved on two runs was within 30 and 45 yards of the target from 10,000ft.

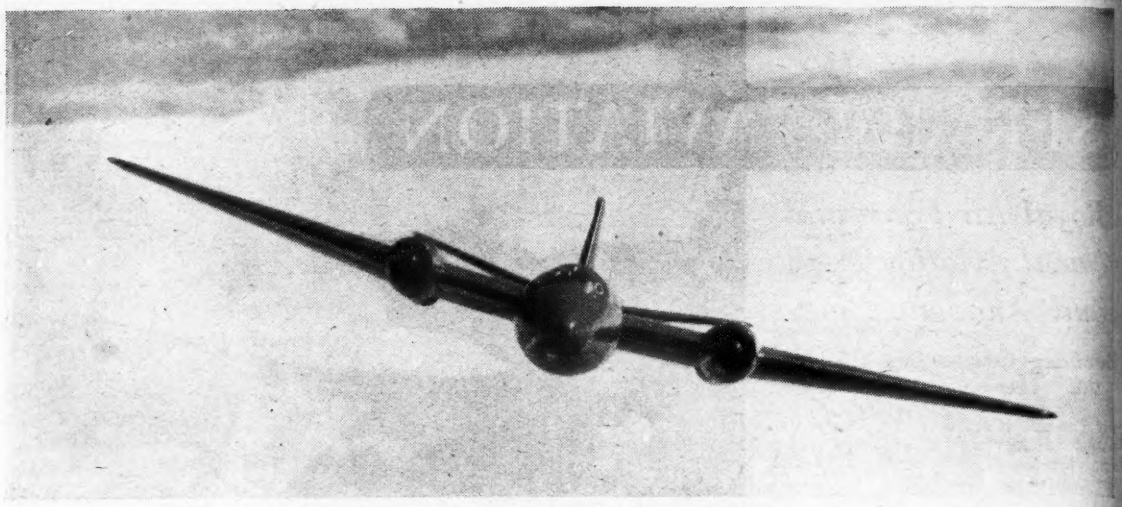
C.A.S. AT CANADAIRS: Concluding his recent tour of the U.S. and Canada, Lord Tedder visited the Canadair works at Cartierville and inspected the last of 22 *Argonaut*-class airliners in production for B.O.A.C. Among his companions were (third from right) Mr. H. Oliver West, president and general manager of Canadair, Ltd., and (right) Air Marshal W. A. Curtis, Chief of the Canadian Air Staff.

R.A.F. Appointment

THE Air Ministry announces the appointment of A.V-M. V. E. Groom, C.B., C.B.E., D.F.C., as Air Officer Commanding, No. 205 Group, Middle East Air Force. Until recently A.V-M. Groom was Director-General of Manning at the Air Ministry, a post he took up in January, 1947, after having been Air Officer in Charge of Administration at H.Q. Flying Training Command, from August, 1945. Previously he was for two years with the 2nd T.A.F., which he joined as S.A.S.O. in September, 1943, after a period on air staff planning duties at Fighter Command H.Q. and on special planning duties at Air Ministry.

Air Vice-Marshal Victor E. Groom.

Earlier in the war he was in the Air Ministry Directorate of Plans for a year and in 1940-41 commanded the R.A.F. bomber station at Marham, Norfolk. Born in August, 1898, he joined the 28th London Regiment (Artists' Rifles) in



SPEED IN ATTACK : At the Farnborough display, W/C. Roland Beamont's performance in the English Electric Canberra was spectacular proof that the new jet bomber is not only capable of delivering its bomb-load at the speed of a fighter, but that its powers of manœuvre, also, are worthy of an intercepter. In this head-on view the extreme cleanness of its fuselage and small frontal area of the Avon turbojets are particularly apparent.

SERVICE AVIATION . . .

1916, was commissioned in 1917, and transferred to the R.F.C., and thence to the R.A.F. in 1918. He was awarded the D.F.C. in 1918 for gallantry in France and a Bar to the D.F.C. in 1921 for services in Mesopotamia.

Education Prize Awarded

CPL. R. Essam, a former Halton apprentice now serving as a wireless fitter in B.A.F.O., is announced as the winner, among 750 R.A.F. candidates, of the Curtis Memorial Prize. He was judged to be the best all-round R.A.F. candidate receiving the Forces Preliminary Examination Certificate at the half yearly examination held last May. The Prize commemorates the late Col. Ivor Curtis, who was educational adviser to the Service from 1918 to 1928.

"RATGroup" Tour

TWO A.T.C. cadets have been chosen to accompany A.V-M. S. D. Macdonald, Assistant Chief of the Air Staff (Training), when he visits the headquarters of the Rhodesian Air Training Group early next month. In Rhodesia he will discuss problems affecting pilot and navigator training in the Group. A.V-M. Macdonald's Lancastrian is also due to call in at Air Headquarters at Aden, Malta and Gibraltar, and he is expected to have discussions with the A.O.C.-in-C., Middle East Air Force.

The two cadets—F/S. R. Brooks and Cpl P. N. Legge—will both enter the R.A.F. shortly. Brooks has enlisted as aircrew, and Legge has been accepted as a Cranwell cadet.

A.C.C.'S INSPECTION : H.R.H. the Duchess of Gloucester, Air Chief Commandant of the Women's Royal Air Force, inspects a W.R.A.F. guard of honour on arrival at Buckeburg to begin her recent tour of B.A.F.O. Accompanying the Duchess are (left to right) Air Marshal T. M. Williams, A.O.C.-in-C., and Group Officer J. L. A. Conan-Doyle.

Senior R.A.F. Posts

IT is expected that, following the retirement (which will take place in March, 1950) of Air Chief Marshal Sir William Medhurst, senior R.A.F. member of the British Joint Services Mission in Washington, there will be a number of consequential re-appointments. In this connection several likely postings have been reported in the London *Daily Telegraph*, but have yet to be confirmed at the time of going to press.

Air Chief Marshal Sir George Pirie, the Air Member for Supply and Organization, will replace Sir Charles Medhurst in Washington, and it is said that Air Marshal Sir William Dickson, the A.O.C.-in-C., Middle East Air Force, may succeed Sir George on the Air Council. The A.O.C.-in-C., Coastal Command, Air Marshal Sir John Baker, is quoted as the new Middle East Commander, being succeeded at Coastal Command by A.V-M. C. R. Steele, A.O.C., Air H.Q., Malta. The present A.O.C.-in-C., Bomber Command, Air Marshal Sir Aubrey Ellwood, may become Deputy Chief of the Air Staff, and the name of his successor is given as Air Marshal Sir Hugh Lloyd, A.O.C.-in-C., Far East Air Force. Other reported appointments are those of A.V-M. F. J. Fogarty, S.A.S.O. of Flying Training Command, as Far East Air Force Commander, and A.V-M. Sir Harry Broadhurst, at present at the Imperial Defence College, as Senior Air Staff Officer, B.A.F.O.

Reunions

DETAILS of a reunion for No. 620 Squadron, R.A.F., to be held in March, 1950, may be obtained from J. L. Elliott, 23a, Brondesbury Road, London, N.W.6.

* * *

A reunion of ex-members of Nos. 11 and 17 Squadrons (Japan—Miho) is to be held on November 26th. Details from F/L. P. B. Andrews, R.A.F. Station, Horsham St. Faith, Norwich.